O I P E
JUL 2 6 2004
PATENT & TRADEMARK OFFICE
JC60

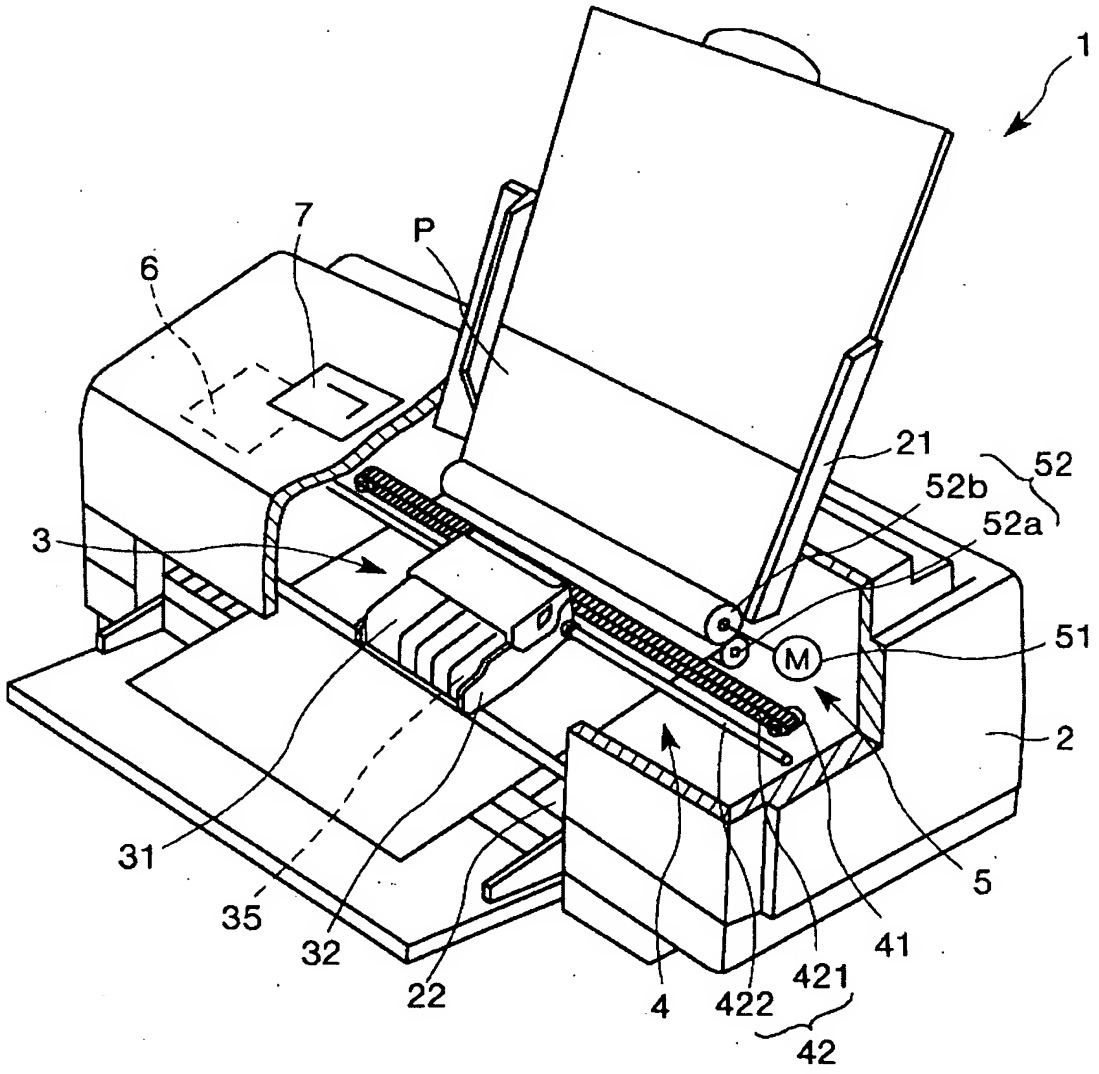

Fig. 1

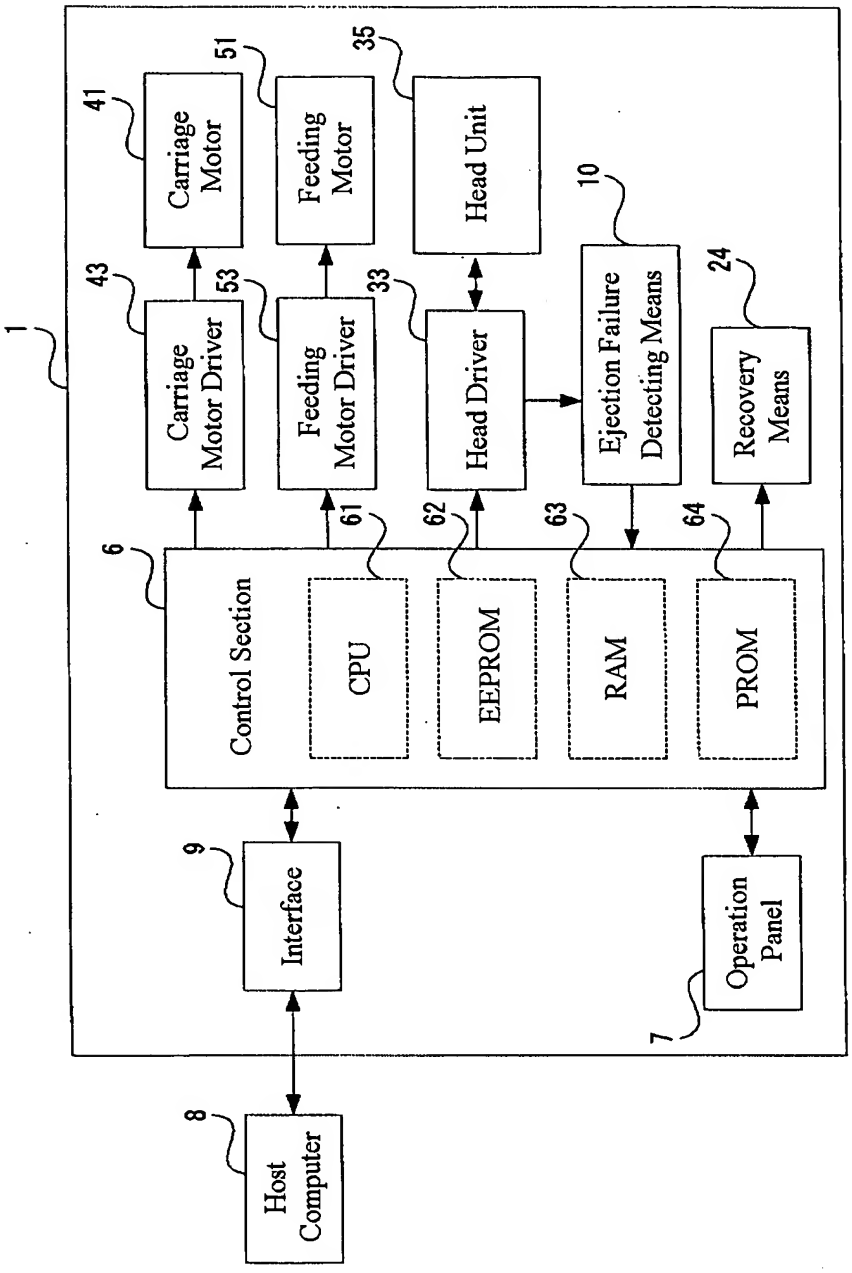
1
Carriage Motor
41
Feeding Motor
51
Head Unit
35
Ejection Failure Detecting Means
10
Recovery Means
24
Carriage Motor Driver
43
Feeding Motor Driver
53
Head Driver
33
6
Control Section
CPU
61
EEPROM
62
RAM
63
PROM
64
Interface
9
Operation Panel
7
Host Computer
8

Fig. 2

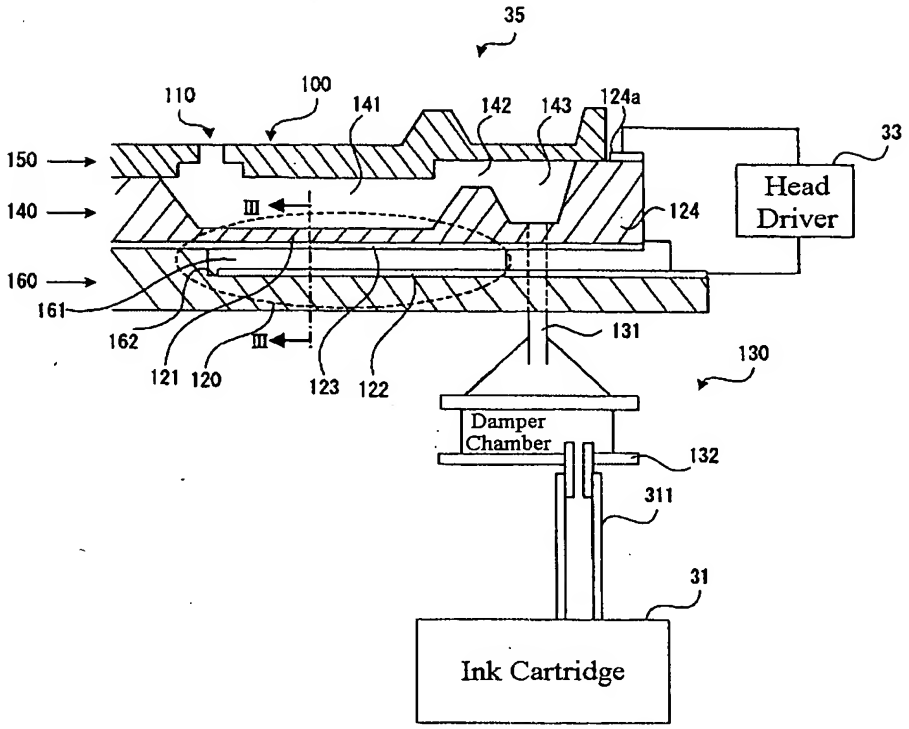
35
110
100
141
142
143
124a
33
150
140
160
161
162
121
120
123
122
124
131
130
Head Driver
Damper Chamber
132
311
31
Ink Cartridge
III
III

Fig. 3

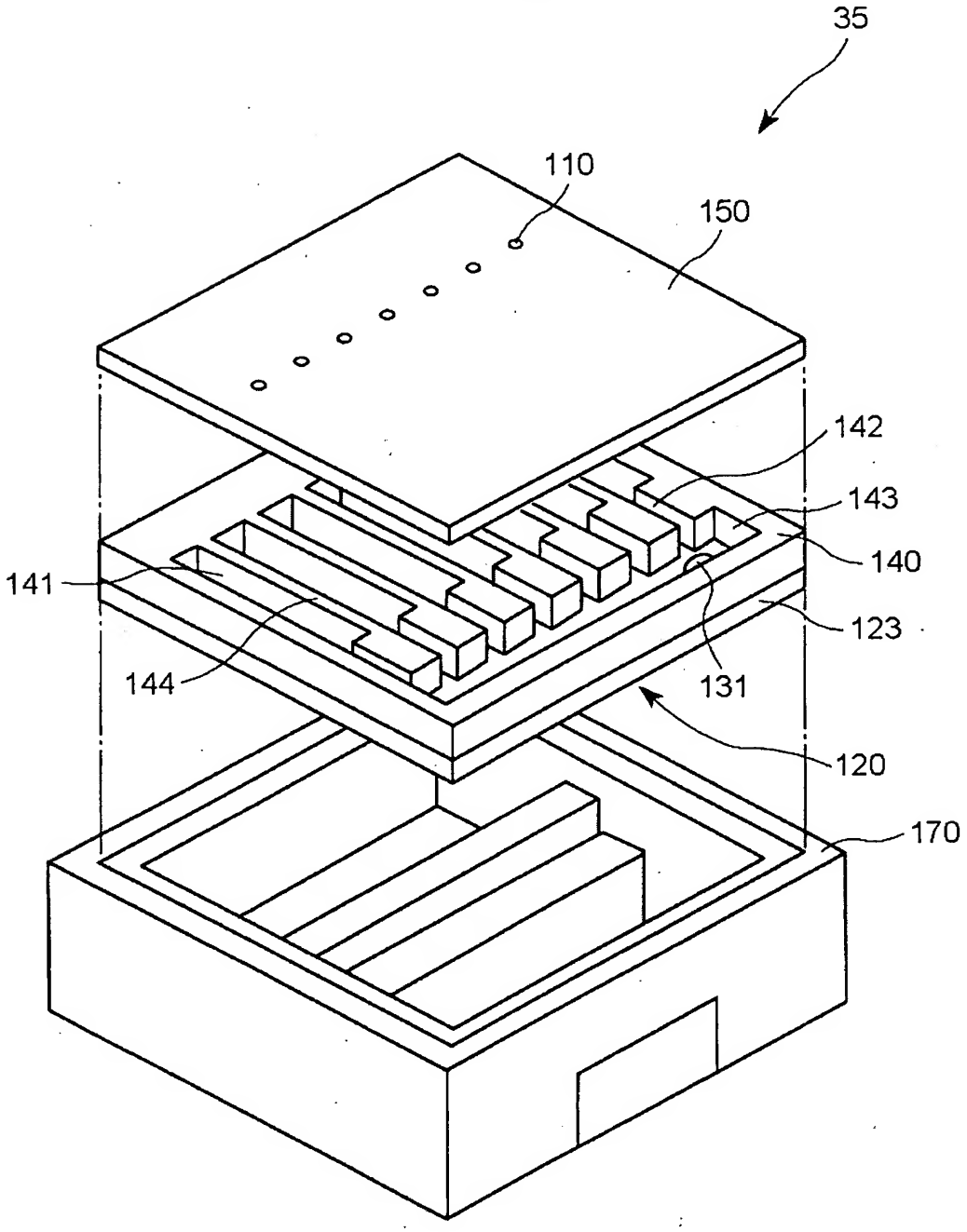

Fig. 4

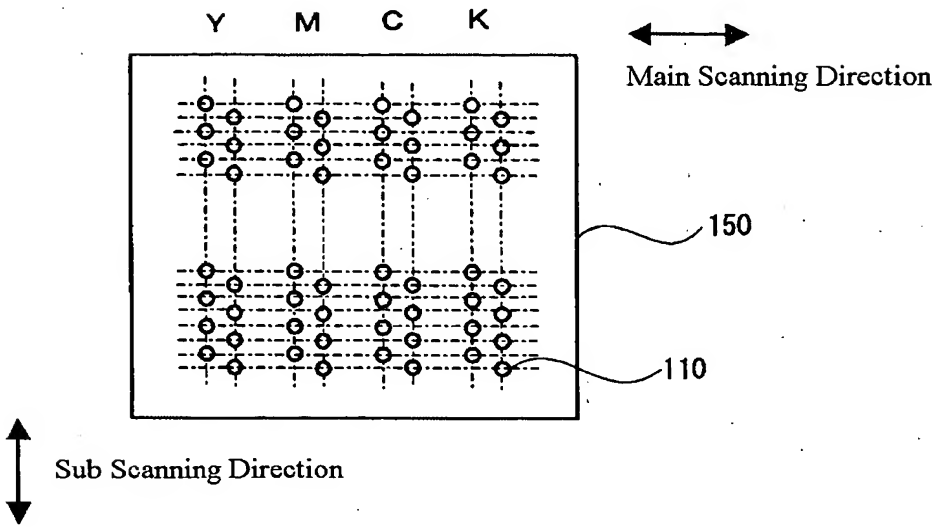
Y
M
C
K
Main Scanning Direction
150
110
Sub Scanning Direction

Fig. 5

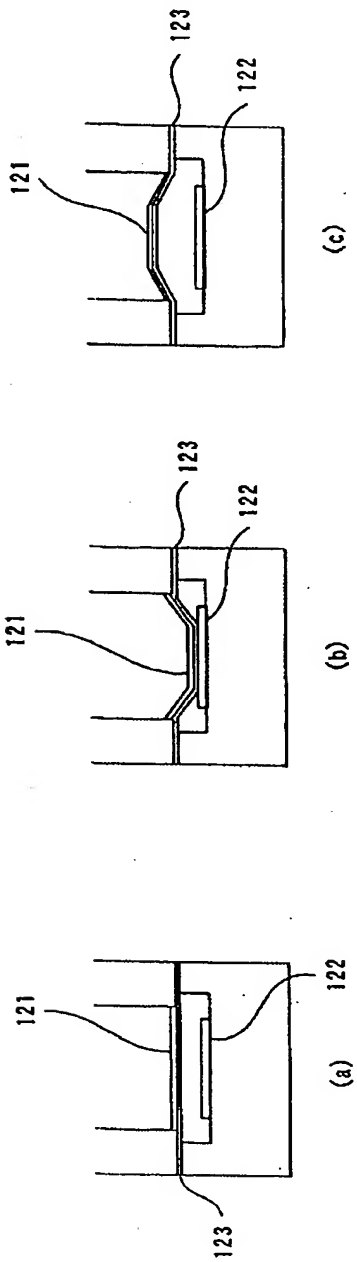

Fig. 6

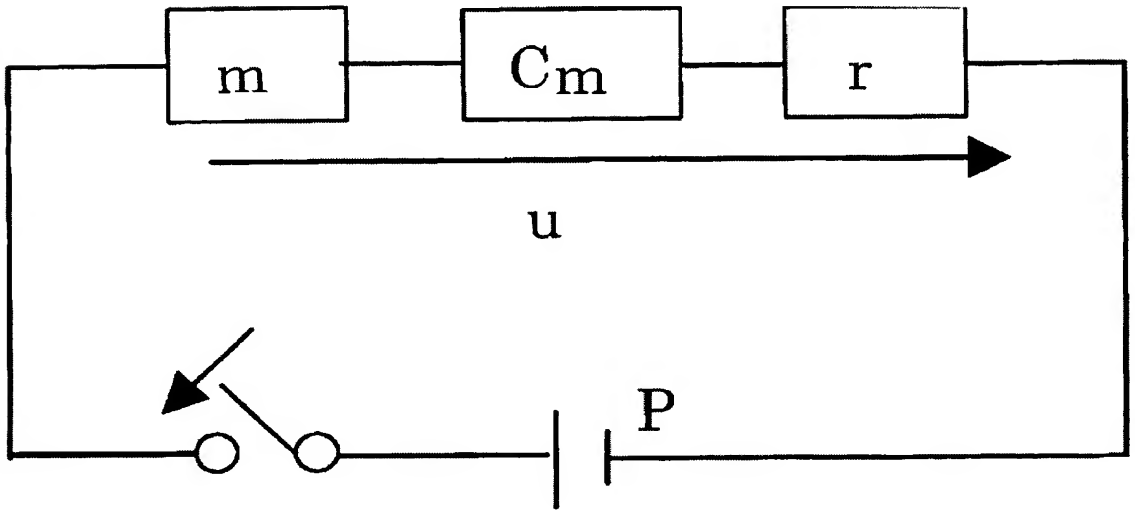

Fig. 7

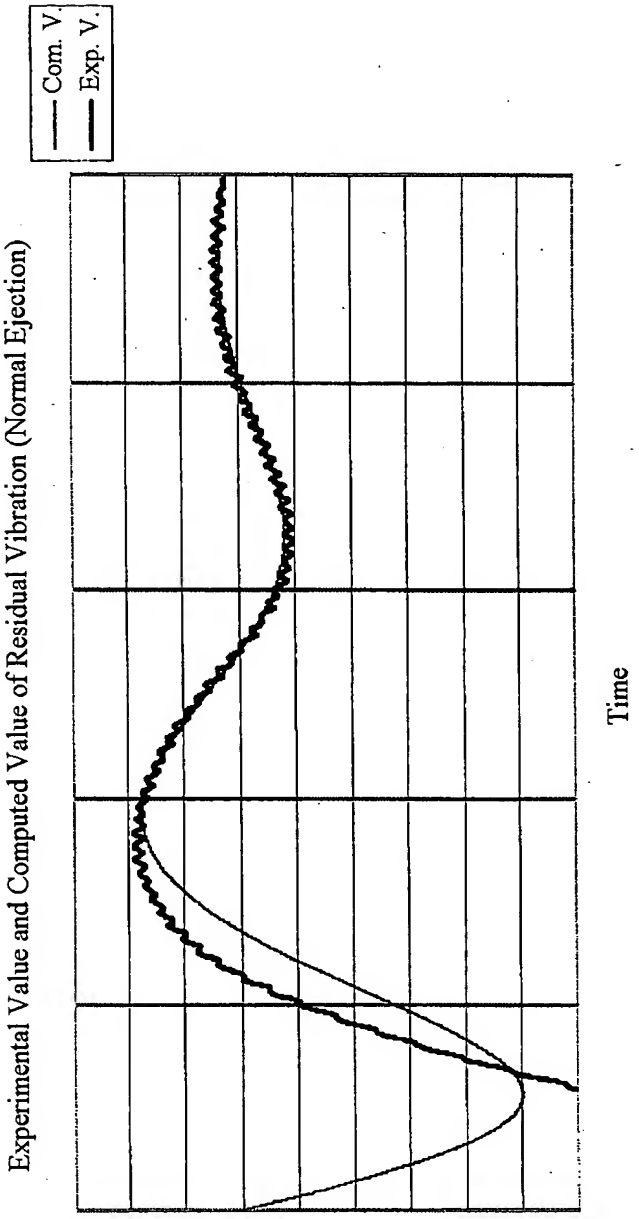
Com. V.
Exp. V.
Experimental Value and Computed Value of Residual Vibration (Normal Ejection)
Time

Fig. 8

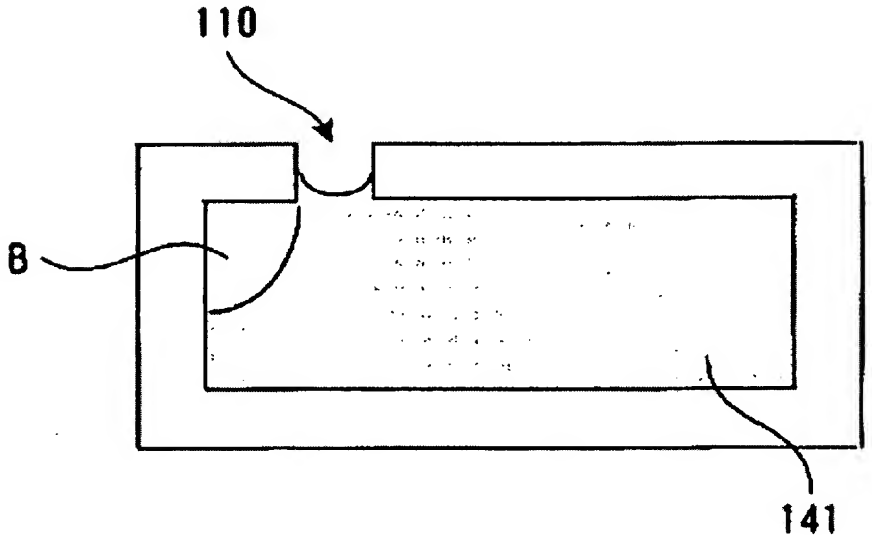

Fig. 9

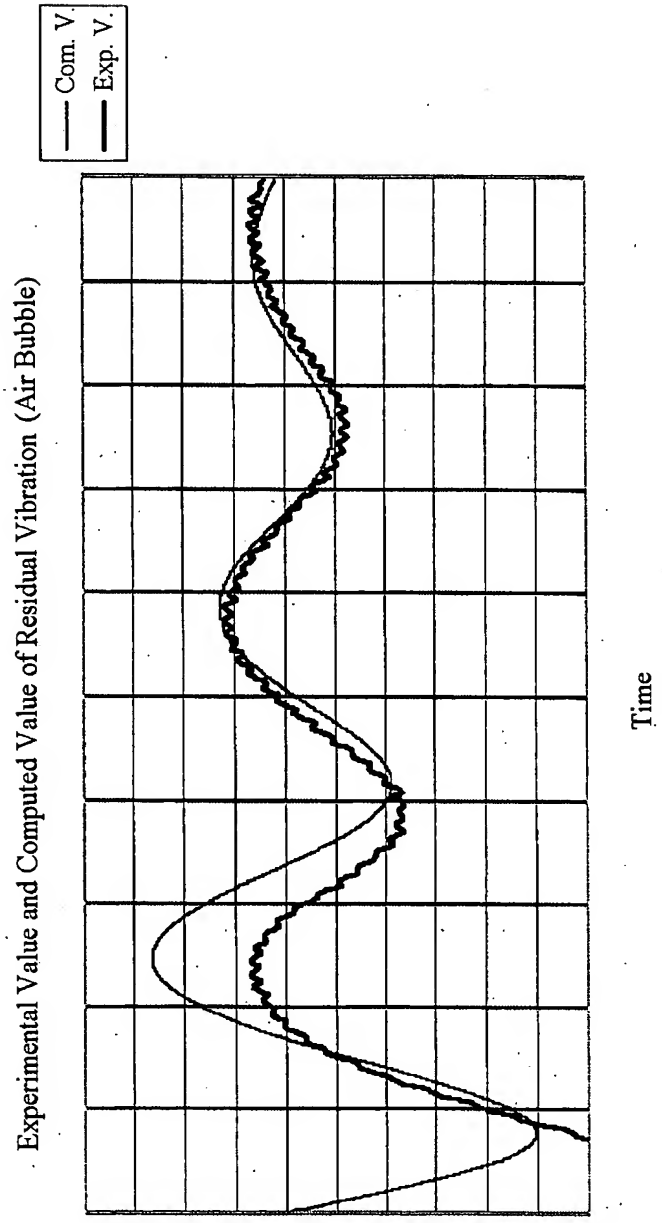
Com. V.
Exp. V.
Experimental Value and Computed Value of Residual Vibration (Air Bubble)
Time

Fig. 10

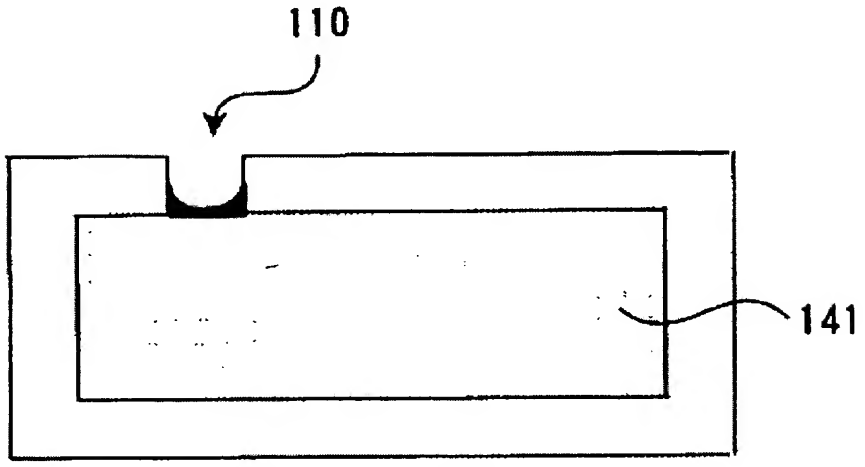

Fig. 11

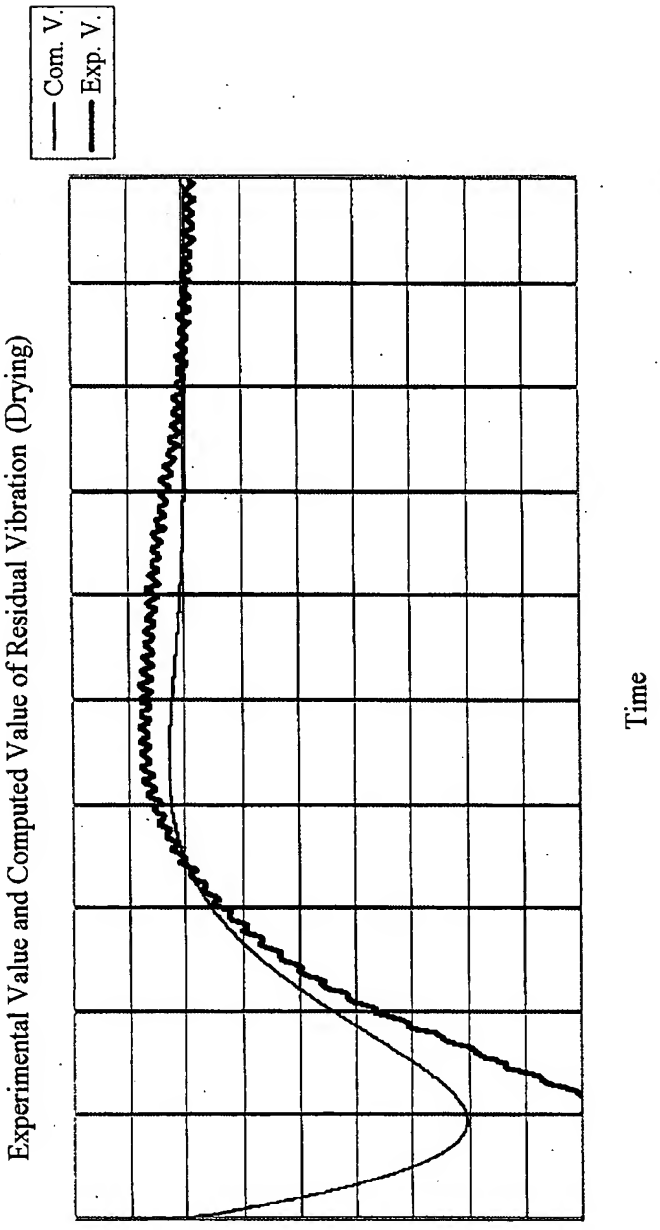
Com. V.
Exp. V.
Experimental Value and Computed Value of Residual Vibration (Drying)
Time

Fig. 12

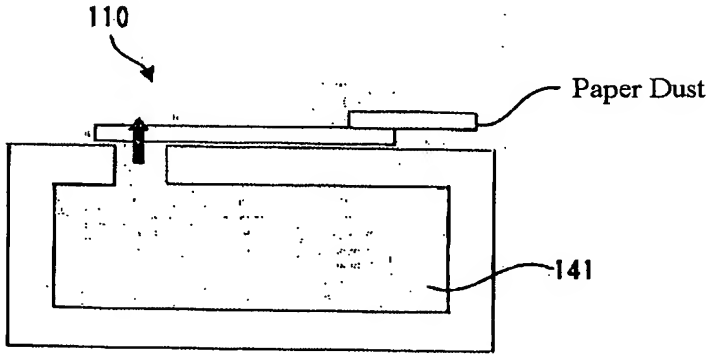

Fig. 13

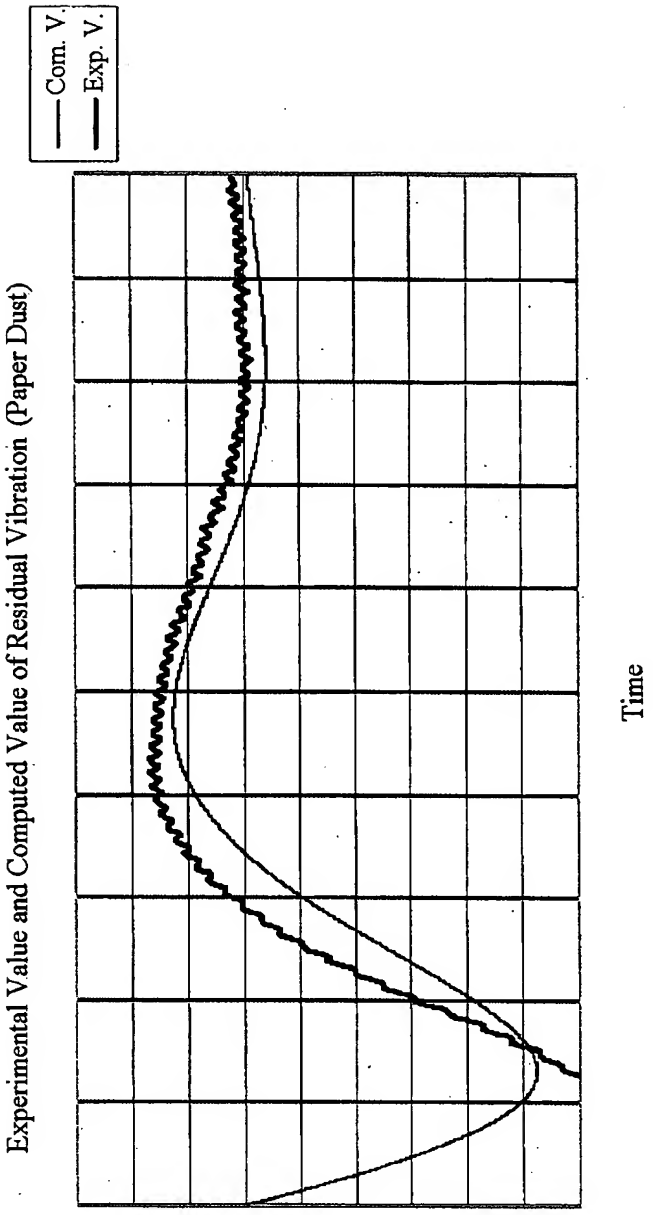
Com. V.
Exp. V.
Experimental Value and Computed Value of Residual Vibration (Paper Dust)
Time

Fig. 14

(a) Before Adhesion of Paper Dust (b) After Adhesion of Paper Dust

Fig. 15

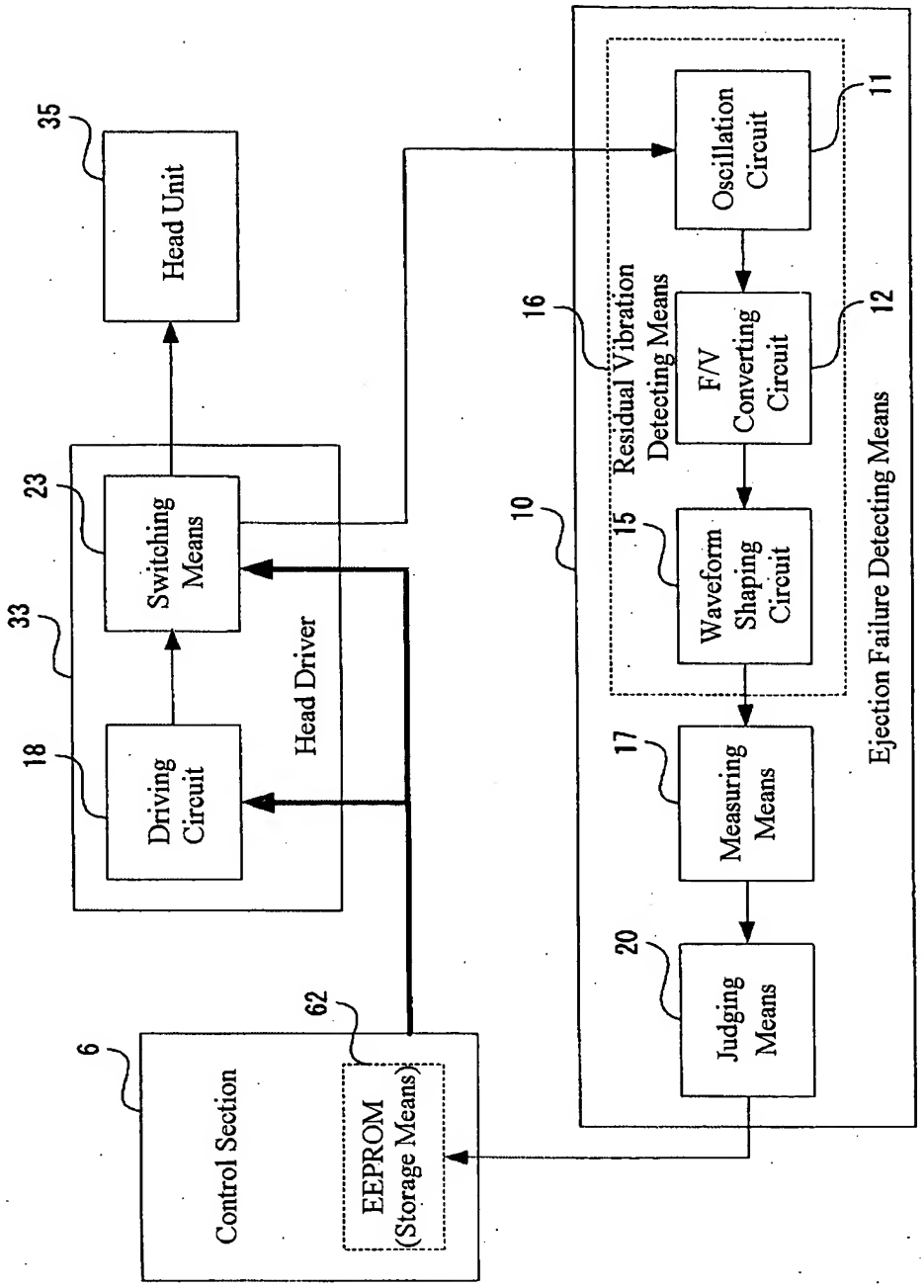
35
Head Unit
23
Switching Means
33
18
Driving Circuit
Head Driver
6
Control Section
62
EEPROM (Storage Means)
10
16
Residual Vibration Detecting Means
Oscillation Circuit
11
F/V Converting Circuit
12
15
Waveform Shaping Circuit
17
Measuring Means
20
Judging Means
Ejection Failure Detecting Means

Fig. 16

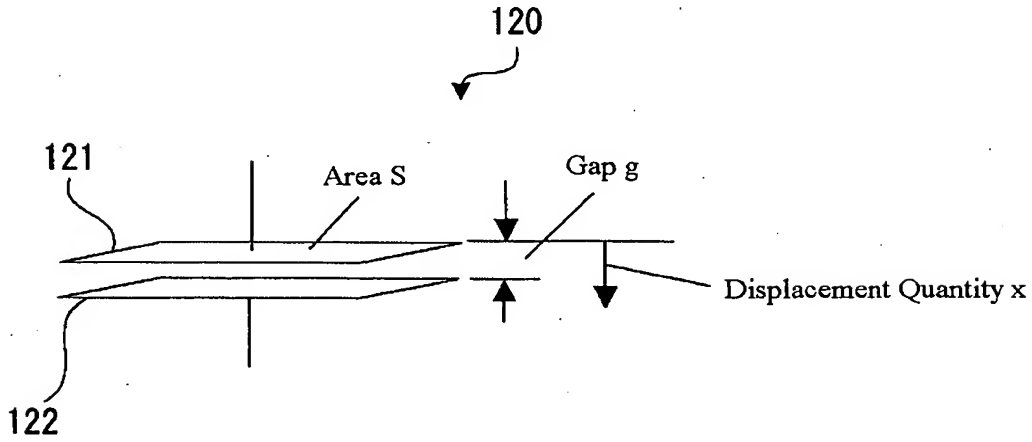
120
121
Area S
Gap g
Displacement Quantity x
122

Fig. 17

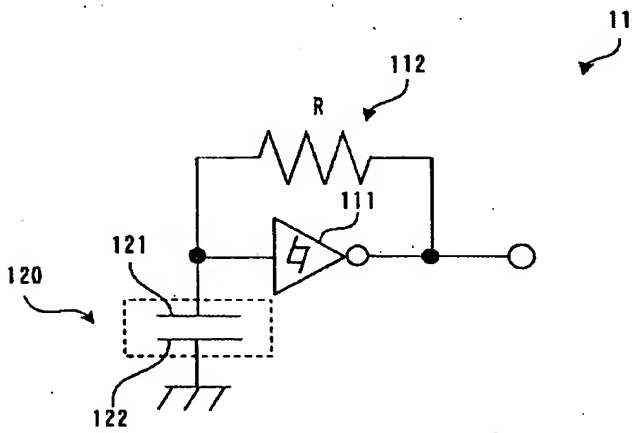
11
112
R
111
121
120
122

Fig. 18

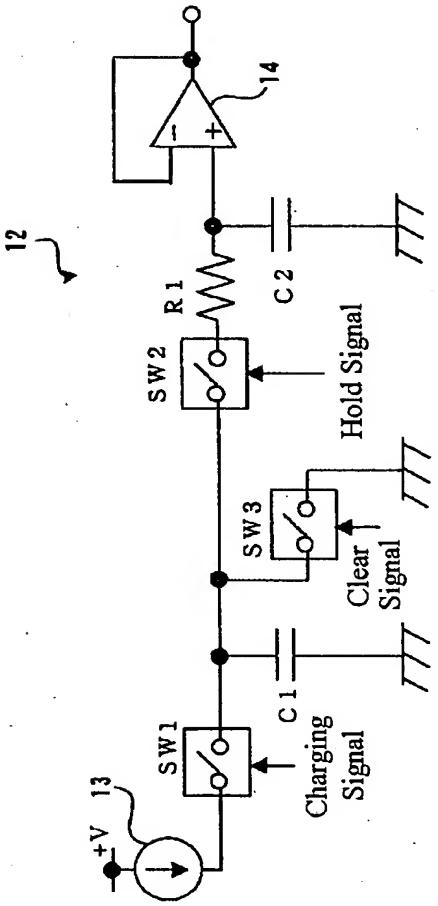
12
14
C 2
R 1
SW 2
Hold Signal
SW 3
Clear Signal
C 1
SW 1
Charging Signal
+V
13

Fig. 19

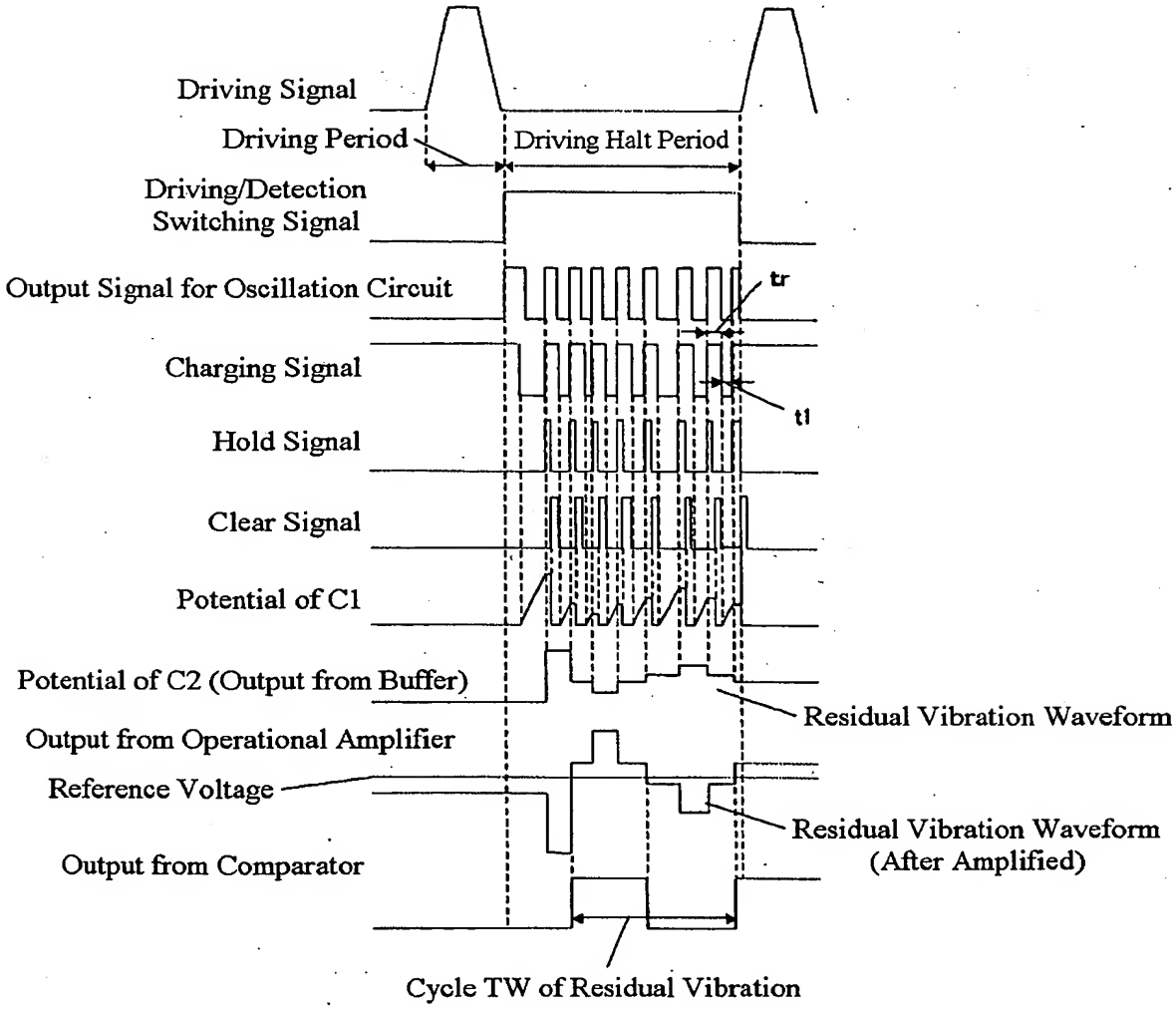
Driving Signal
Driving Period
Driving Halt Period
Driving/Detection Switching Signal
Output Signal for Oscillation Circuit
tr
Charging Signal
t1
Hold Signal
Clear Signal
Potential of C1
Potential of C2 (Output from Buffer)
Residual Vibration Waveform
Output from Operational Amplifier
Reference Voltage
Residual Vibration Waveform (After Amplified)
Output from Comparator
Cycle TW of Residual Vibration

Fig. 20

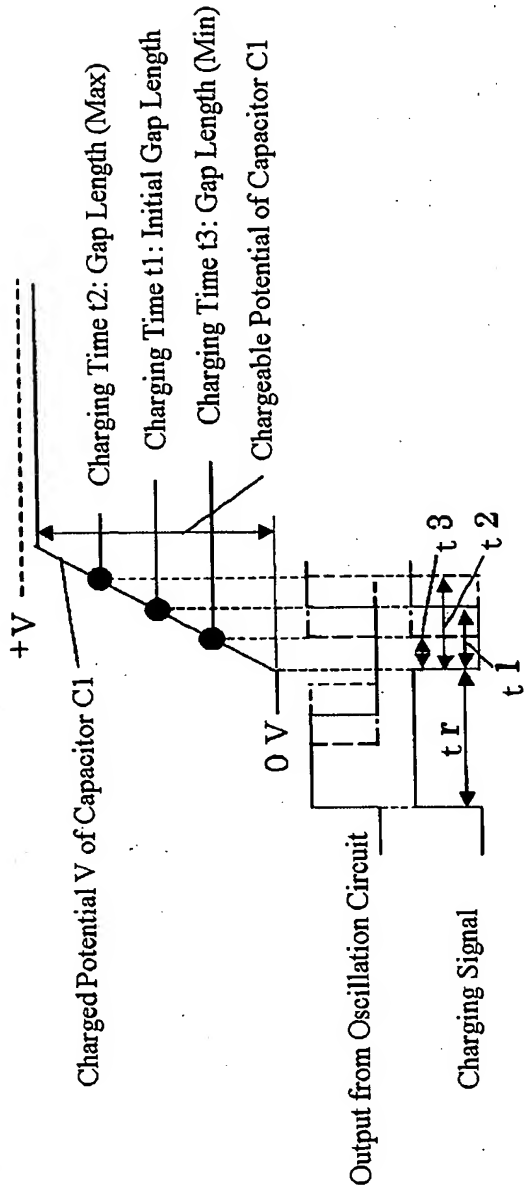
+V
Charging Time t2: Gap Length (Max)
Charging Time t1: Initial Gap Length
Charging Time t3: Gap Length (Min)
Chargeable Potential of Capacitor C1
Charged Potential V of Capacitor C1
0 V
t 3
t 2
t 1
t r
Output from Oscillation Circuit
Charging Signal

Fig. 21

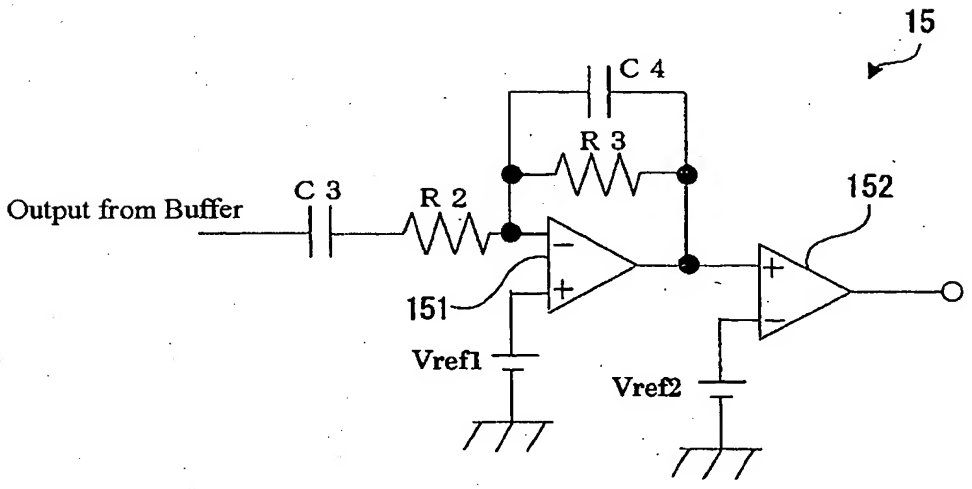

Fig. 22

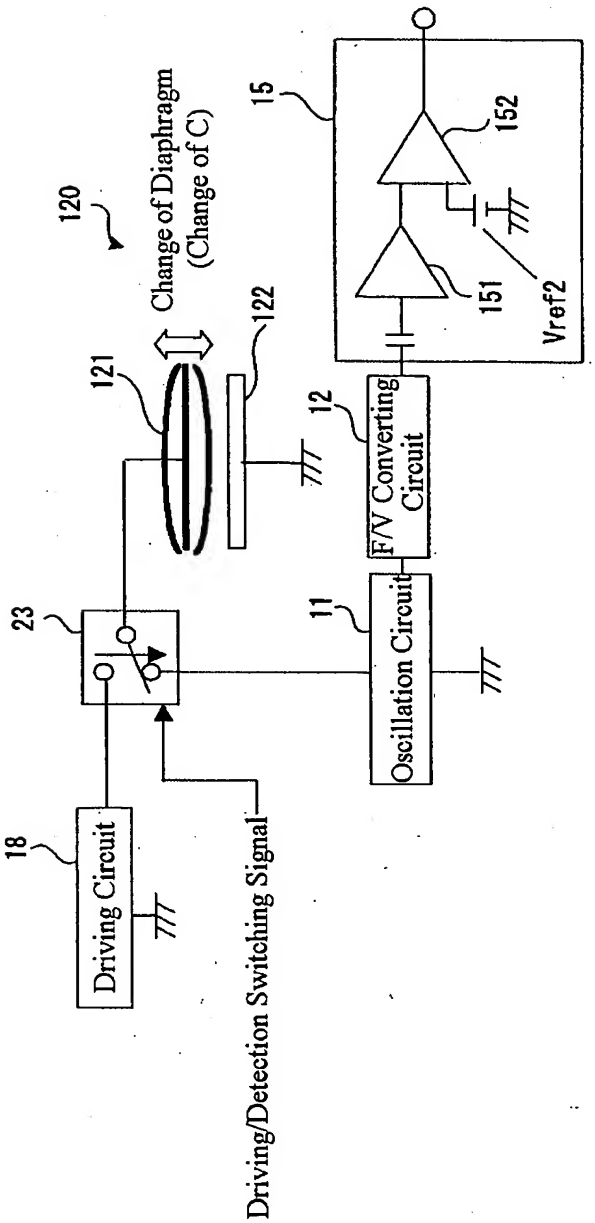
120
Change of Diaphragm
(Change of C)
121
122
15
152
151
Vref2
12
F/V Converting
Circuit
11
Oscillation Circuit
23
18
Driving Circuit
Driving/Detection Switching Signal

Fig. 23

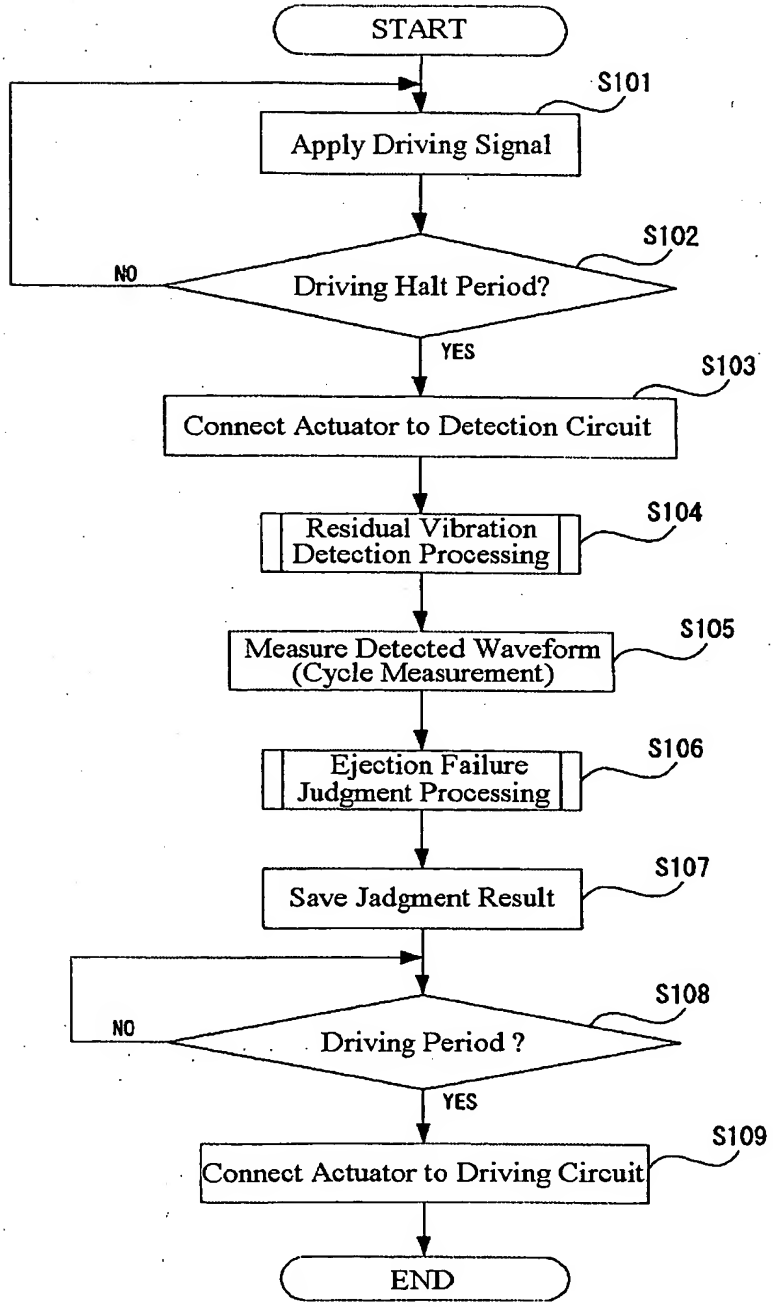
START
S101
Apply Driving Signal
S102
NO
Driving Halt Period?
YES
S103
Connect Actuator to Detection Circuit
S104
Residual Vibration Detection Processing
S105
Measure Detected Waveform (Cycle Measurement)
S106
Ejection Failure Judgment Processing
S107
Save Jadgment Result
S108
NO
Driving Period ?
YES
S109
Connect Actuator to Driving Circuit
END

Fig. 24

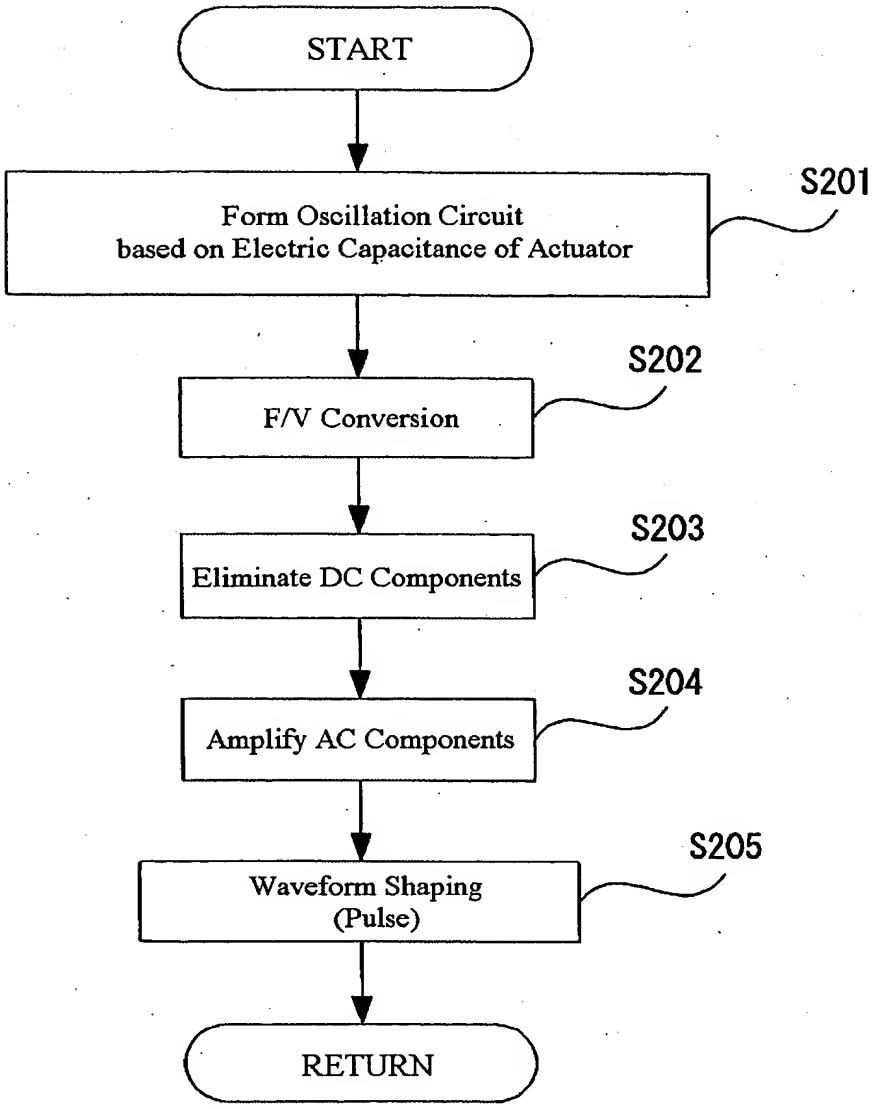
START
Form Oscillation Circuit based on Electric Capacitance of Actuator
S201
F/V Conversion
S202
Eliminate DC Components
S203
Amplify AC Components
S204
Waveform Shaping (Pulse)
S205
RETURN

Fig. 25

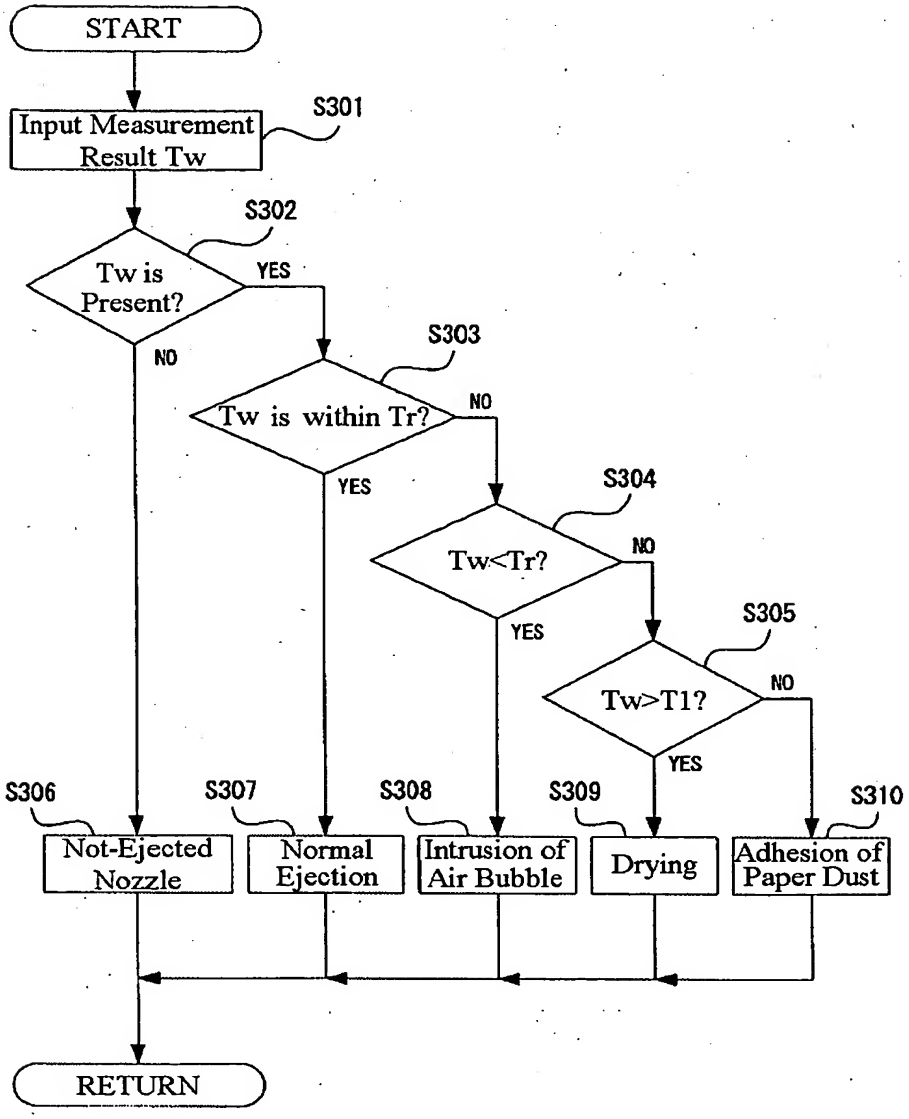
START
Input Measurement Result Tw
S301
S302
Tw is Present?
YES
NO
S303
Tw is within Tr?
NO
YES
S304
Tw<Tr?
NO
YES
S305
Tw>T1?
NO
YES
S306
S307
S308
S309
S310
Not-Ejected Nozzle
Normal Ejection
Intrusion of Air Bubble
Drying
Adhesion of Paper Dust
RETURN

Fig. 26

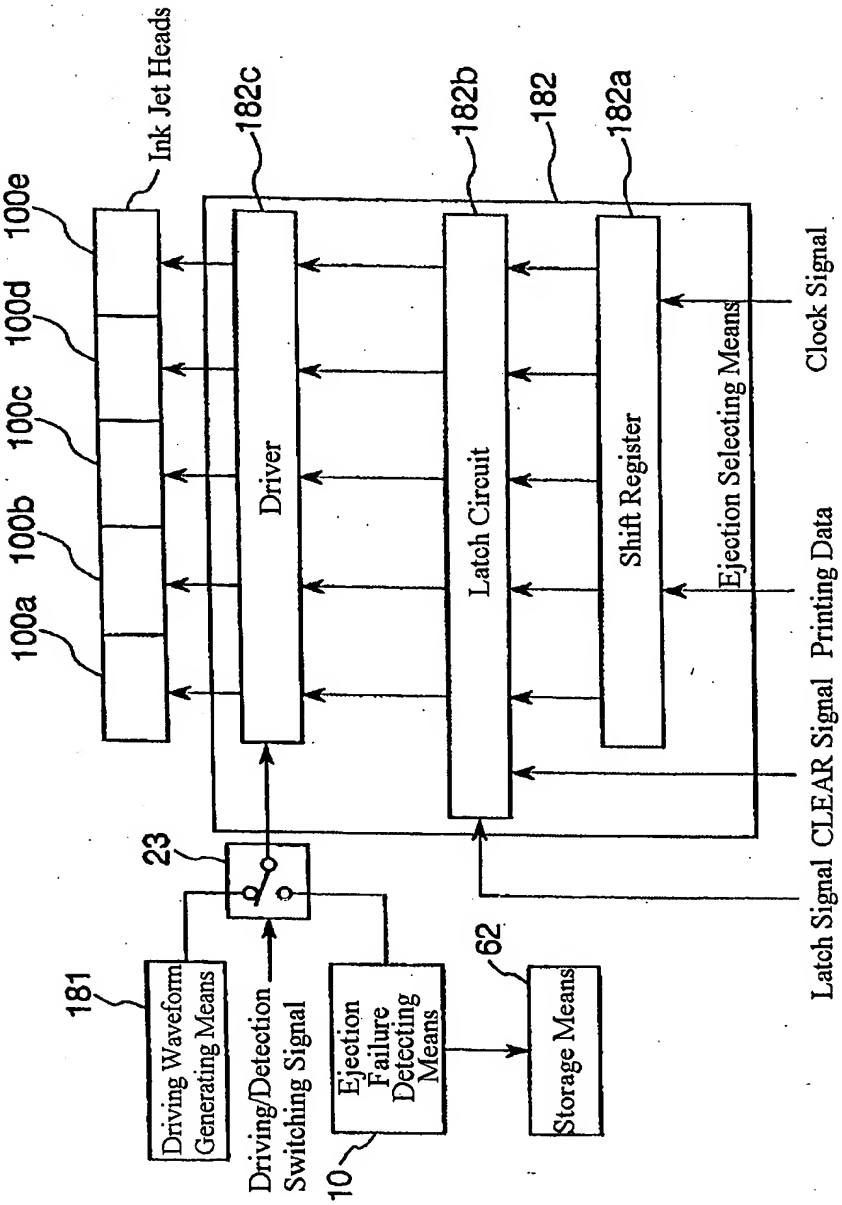
Ink Jet Heads
100e
100d
100c
100b
100a
182c
Driver
182b
Latch Circuit
182
182a
Shift Register
Ejection Selecting Means
Clock Signal
Printing Data
CLEAR Signal
Latch Signal
23
181
Driving Waveform Generating Means
Driving/Detection Switching Signal
Ejection Failure Detecting Means
10
62
Storage Means

Fig. 27

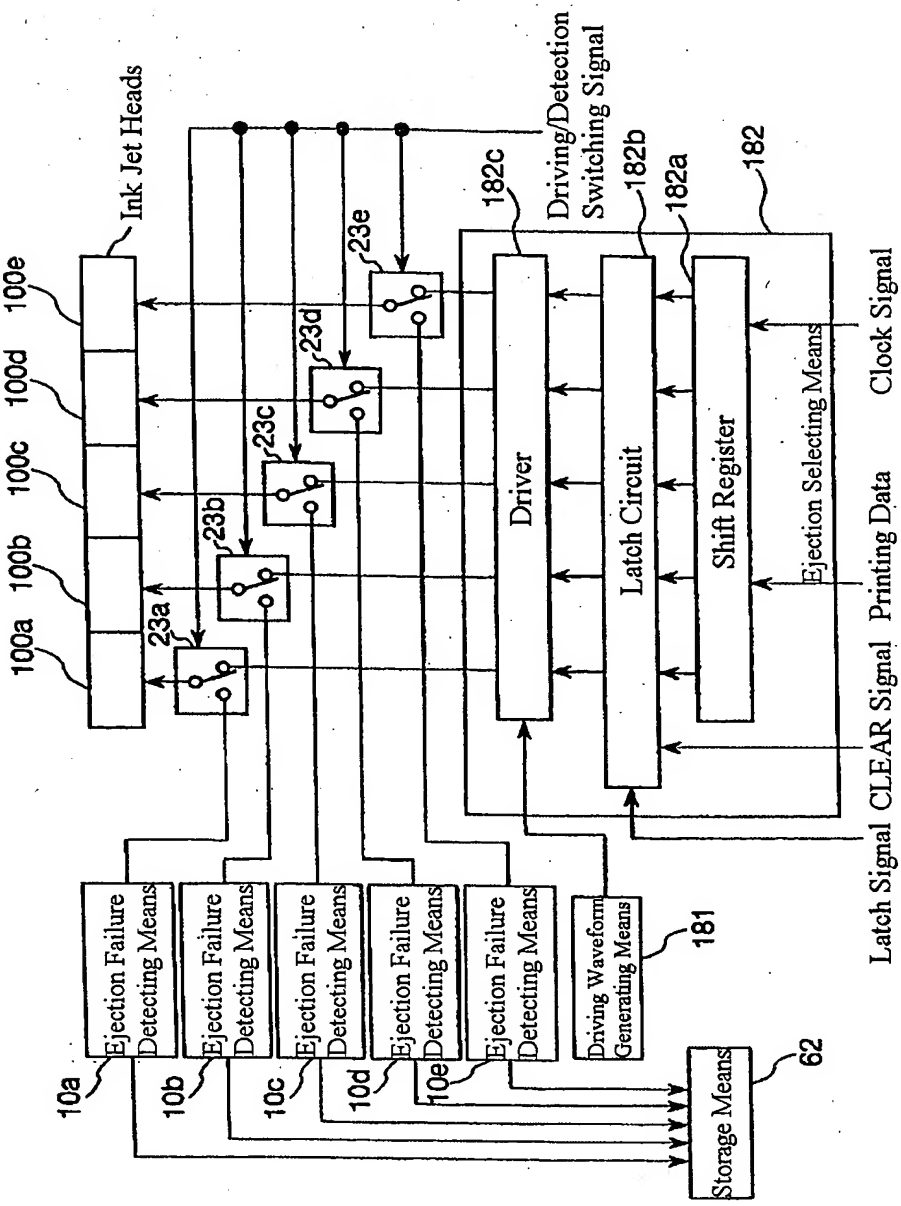
Ink Jet Heads
100e
100d
100c
100b
100a
23e
23d
23c
23b
23a
182c
182b
182a
182
Driving/Detection Switching Signal
Driver
Latch Circuit
Shift Register
Ejection Selecting Means
Clock Signal
Printing Data
CLEAR Signal
Latch Signal
Ejection Failure Detecting Means
Driving Waveform Generating Means
181
Storage Means
62
10a
10b
10c
10d
10e

Fig. 28

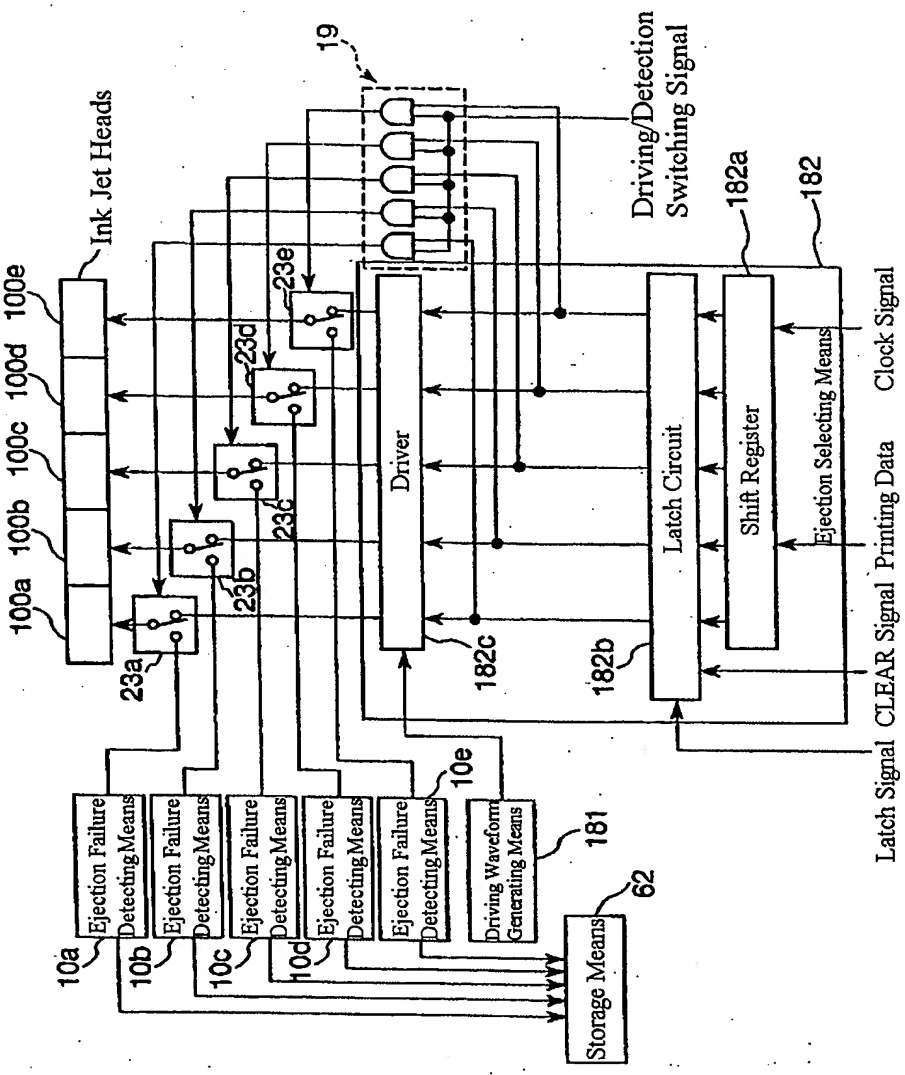
Ink Jet Heads
100a
100b
100c
100d
100e
19
Driving/Detection Switching Signal
182a
182
23a
23b
23c
23d
23e
Driver
182c
182b
Latch Circuit
Shift Register
Ejection Selecting Means
Clock Signal
Printing Data
CLEAR Signal
Latch Signal
Ejection Failure Detecting Means
10a
10b
10c
10d
10e
Driving Waveform Generating Means
181
Storage Means
62

Fig. 29

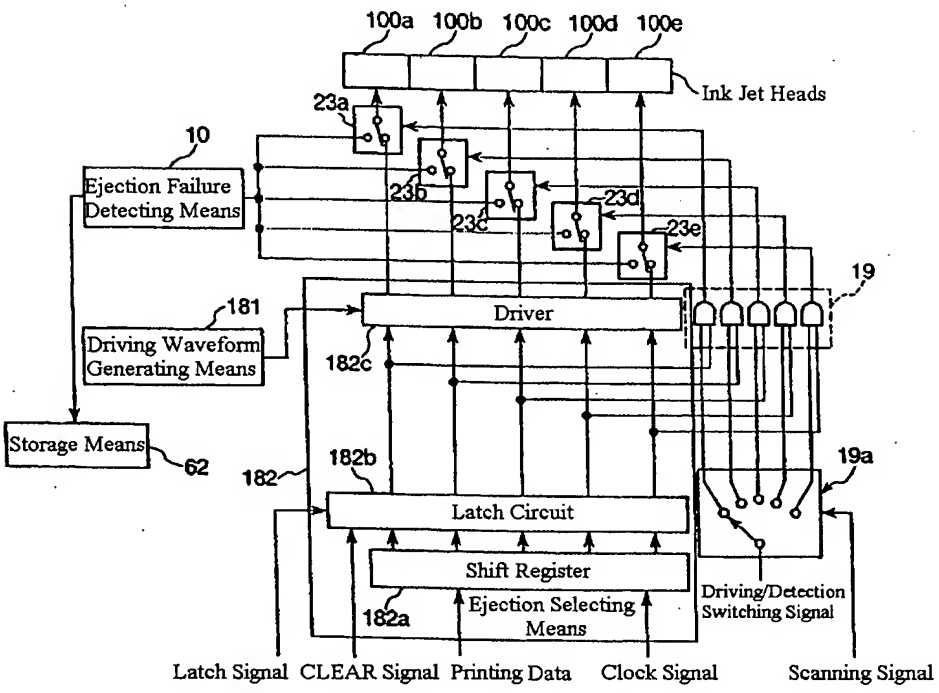
100a
100b
100c
100d
100e
Ink Jet Heads
23a
23b
23c
23d
23e
10
Ejection Failure Detecting Means
19
181
Driving Waveform Generating Means
Driver
182c
Storage Means
62
182
182b
19a
Latch Circuit
Shift Register
182a
Ejection Selecting Means
Driving/Detection Switching Signal
Latch Signal
CLEAR Signal
Printing Data
Clock Signal
Scanning Signal

Fig. 30

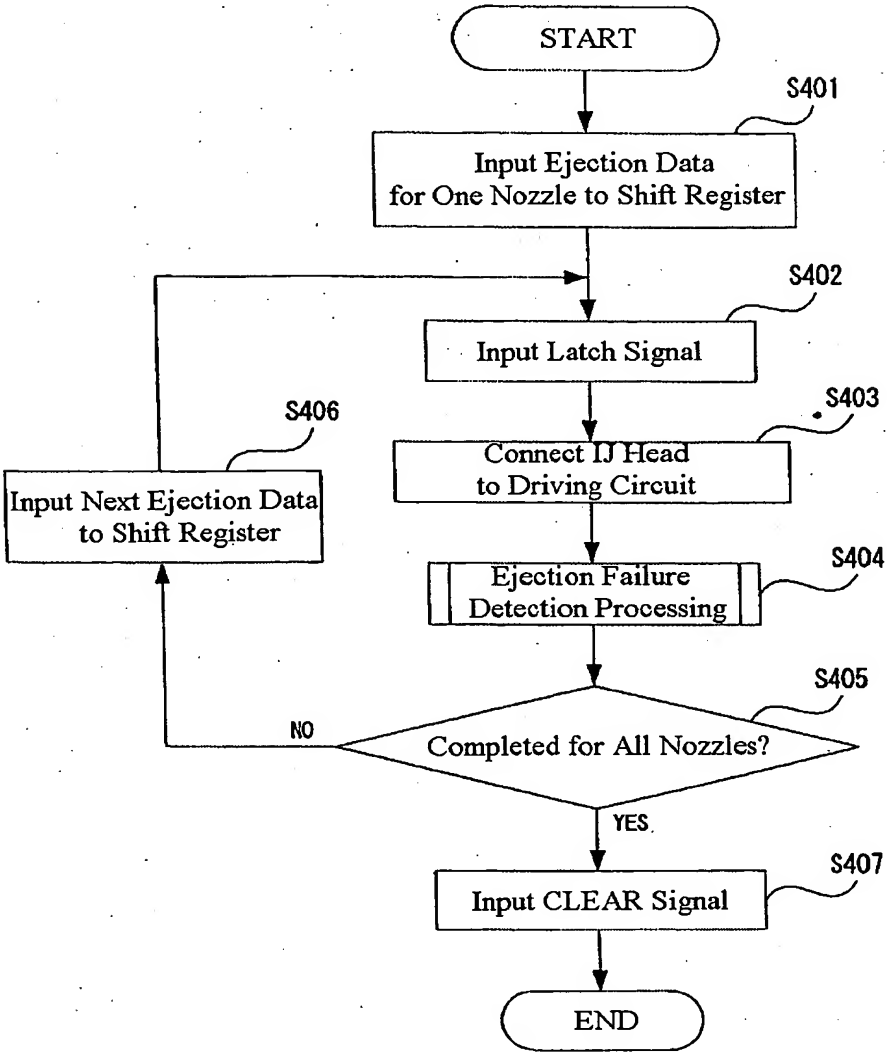
START
S401
Input Ejection Data for One Nozzle to Shift Register
S402
Input Latch Signal
S403
Connect IJ Head to Driving Circuit
S404
Ejection Failure Detection Processing
S405
Completed for All Nozzles?
NO
YES
S406
Input Next Ejection Data to Shift Register
S407
Input CLEAR Signal
END

Fig. 31

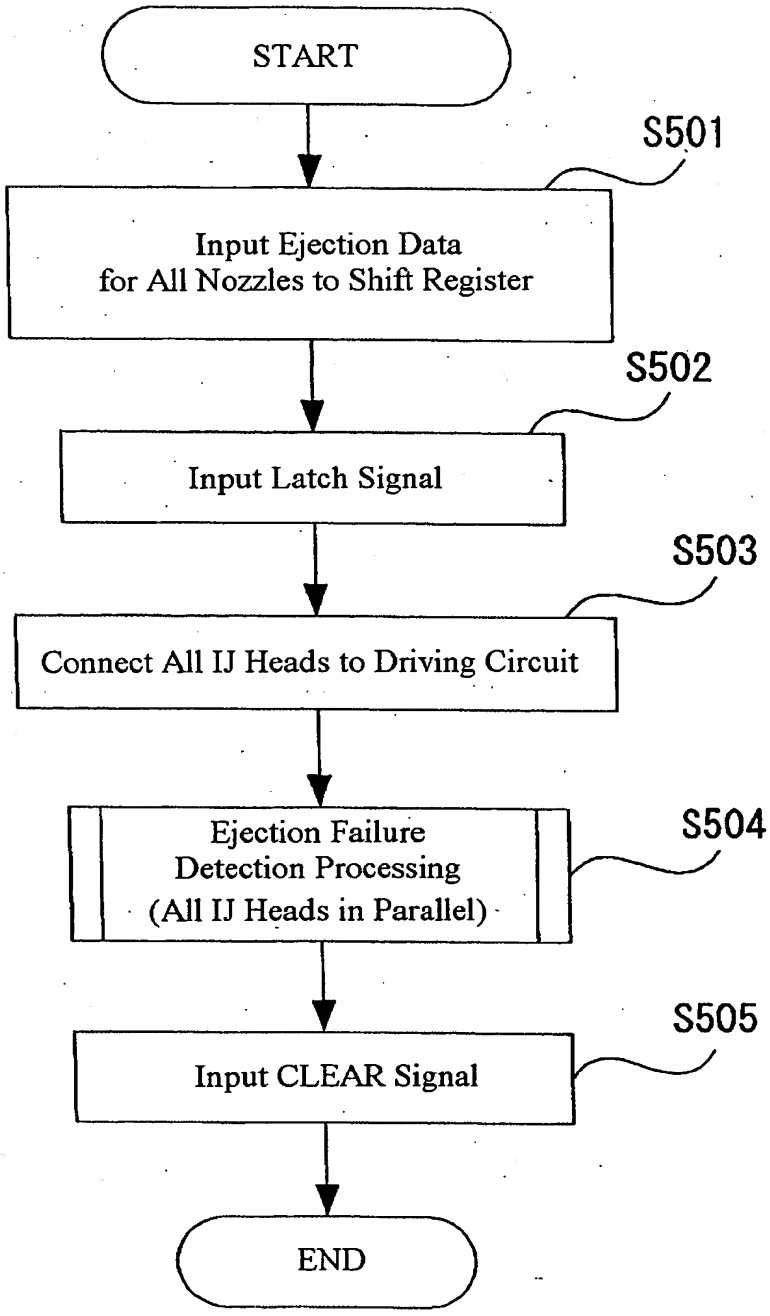
START
S501
Input Ejection Data
for All Nozzles to Shift Register
S502
Input Latch Signal
S503
Connect All IJ Heads to Driving Circuit
Ejection Failure
Detection Processing
(All IJ Heads in Parallel)
S504
S505
Input CLEAR Signal
END

Fig. 32

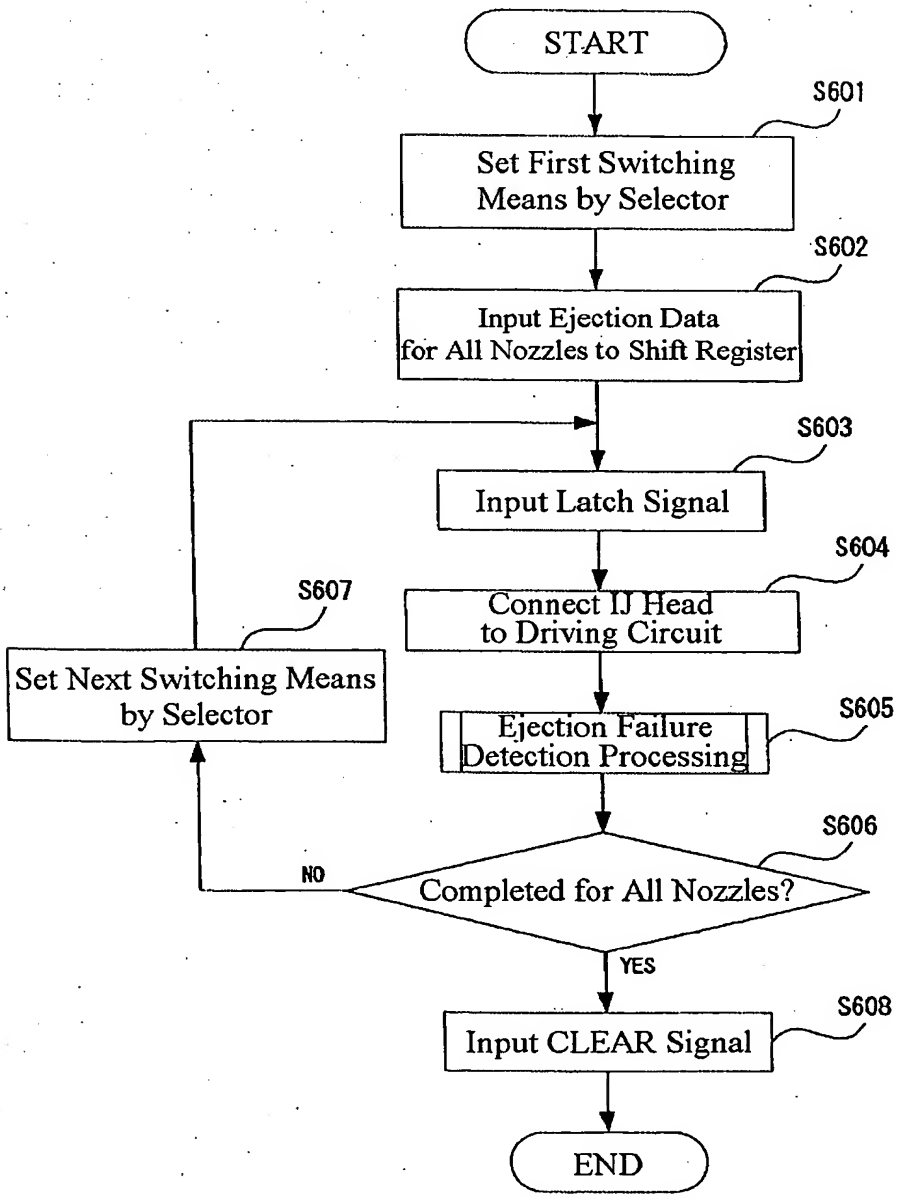
START
S601
Set First Switching Means by Selector
S602
Input Ejection Data for All Nozzles to Shift Register
S603
Input Latch Signal
S604
Connect IJ Head to Driving Circuit
S605
Ejection Failure Detection Processing
S606
Completed for All Nozzles?
NO
YES
S607
Set Next Switching Means by Selector
S608
Input CLEAR Signal
END

Fig. 33

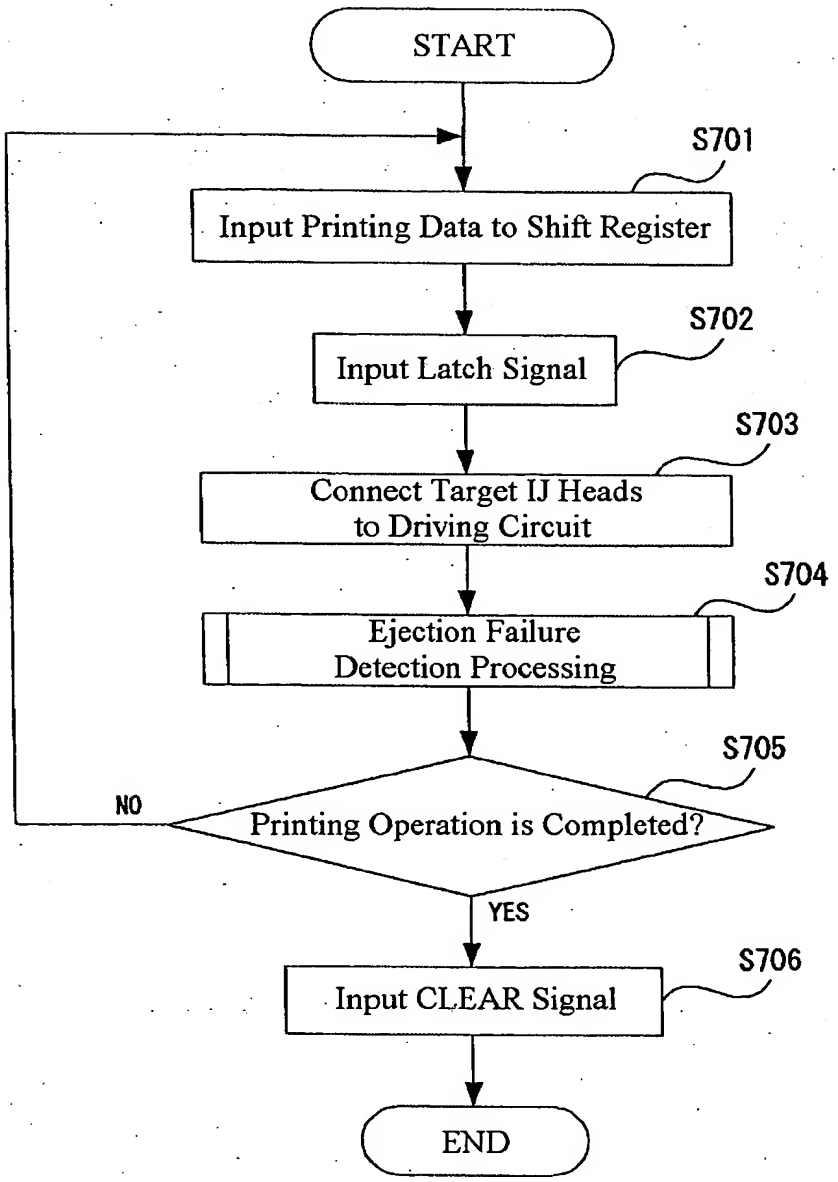
START
S701
Input Printing Data to Shift Register
S702
Input Latch Signal
S703
Connect Target IJ Heads
to Driving Circuit
S704
Ejection Failure
Detection Processing
S705
NO
Printing Operation is Completed?
YES
S706
Input CLEAR Signal
END

Fig. 34

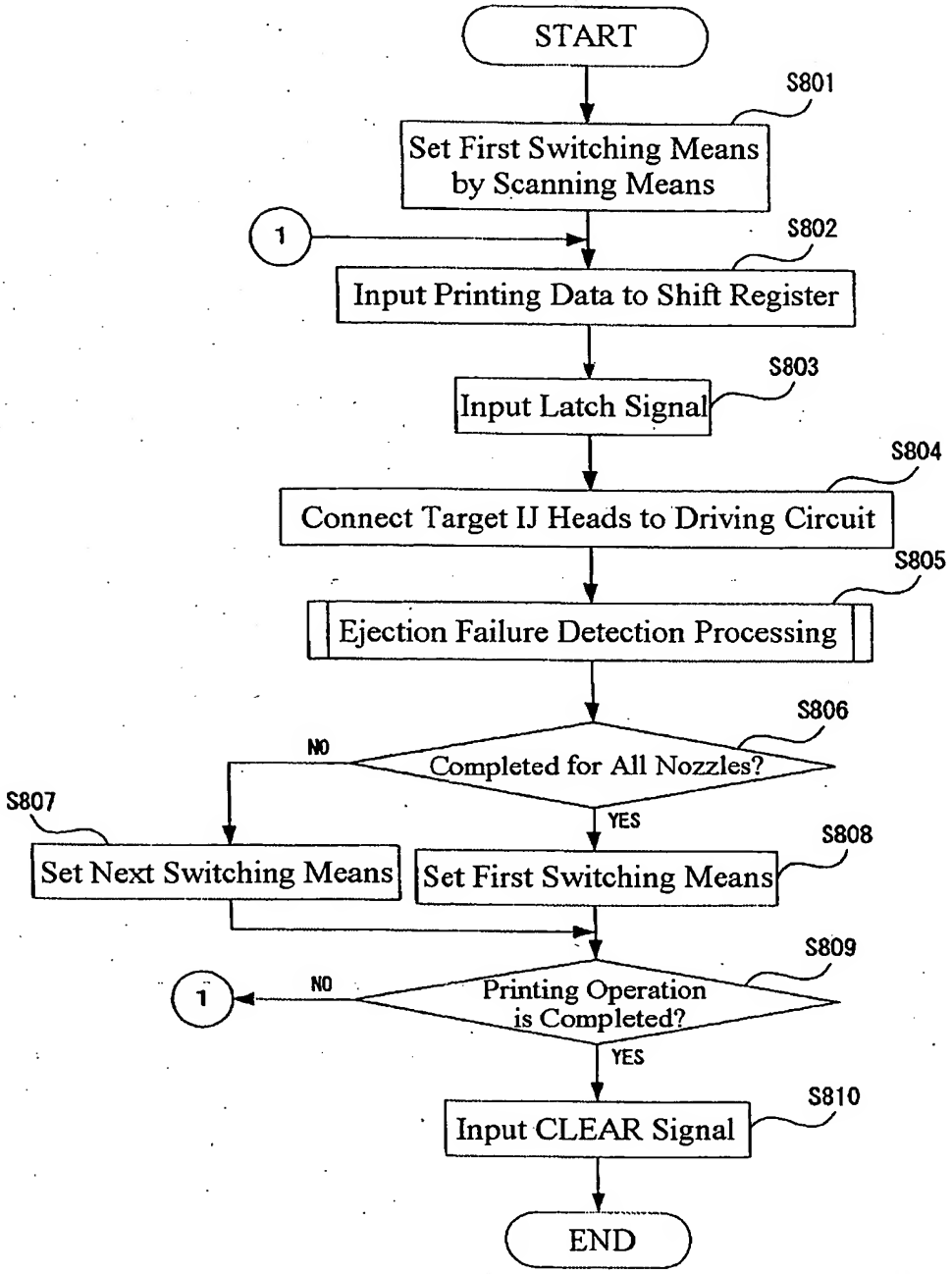
START
S801
Set First Switching Means by Scanning Means
1
S802
Input Printing Data to Shift Register
S803
Input Latch Signal
S804
Connect Target IJ Heads to Driving Circuit
S805
Ejection Failure Detection Processing
S806
NO
Completed for All Nozzles?
YES
S807
Set Next Switching Means
S808
Set First Switching Means
S809
1
NO
Printing Operation is Completed?
YES
S810
Input CLEAR Signal
END

Fig. 35

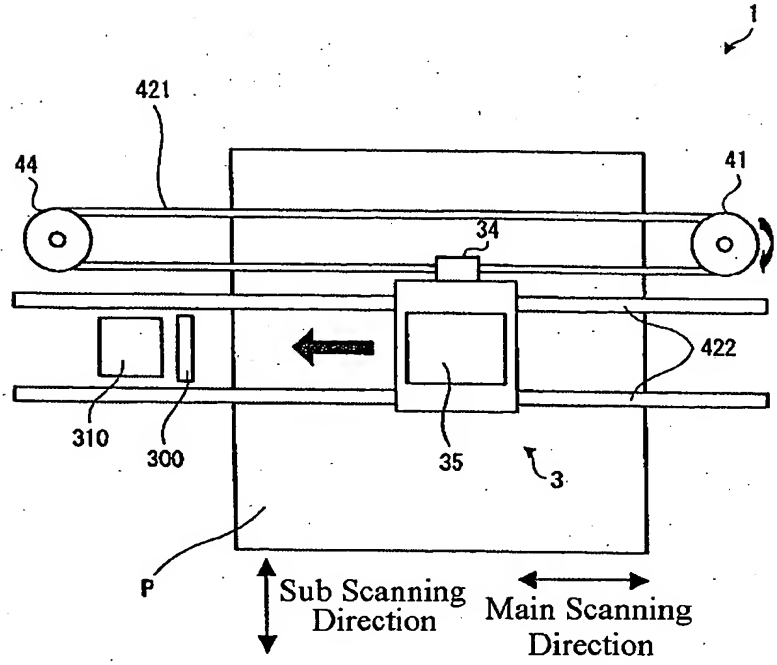
1
421
44
41
34
422
310
300
35
3
P
Sub Scanning Direction
Main Scanning Direction

Fig. 36

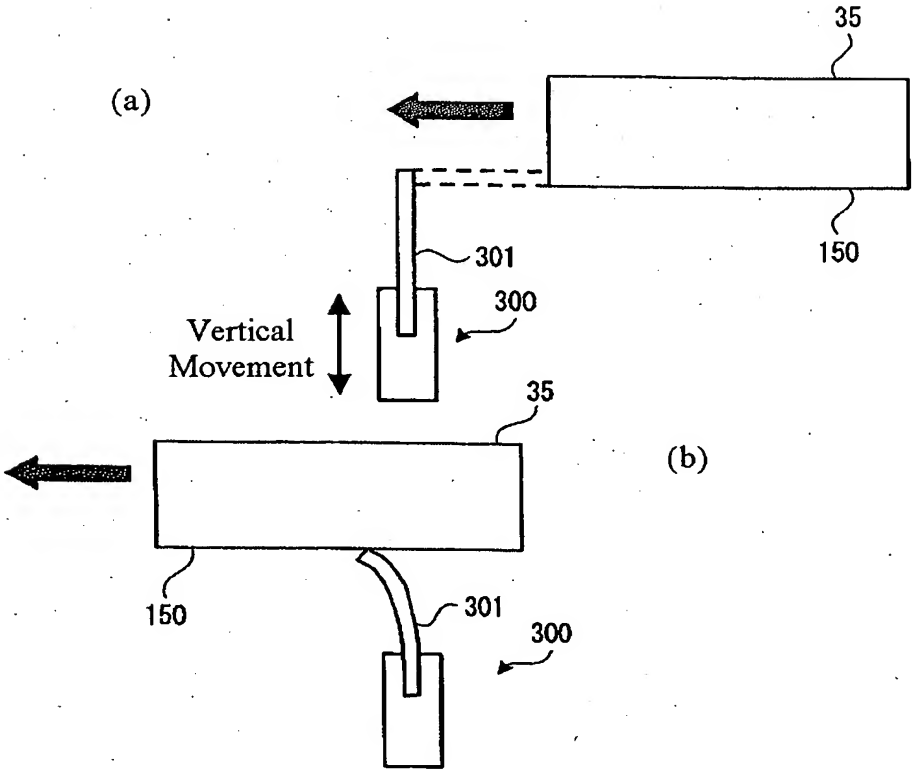

Fig. 37

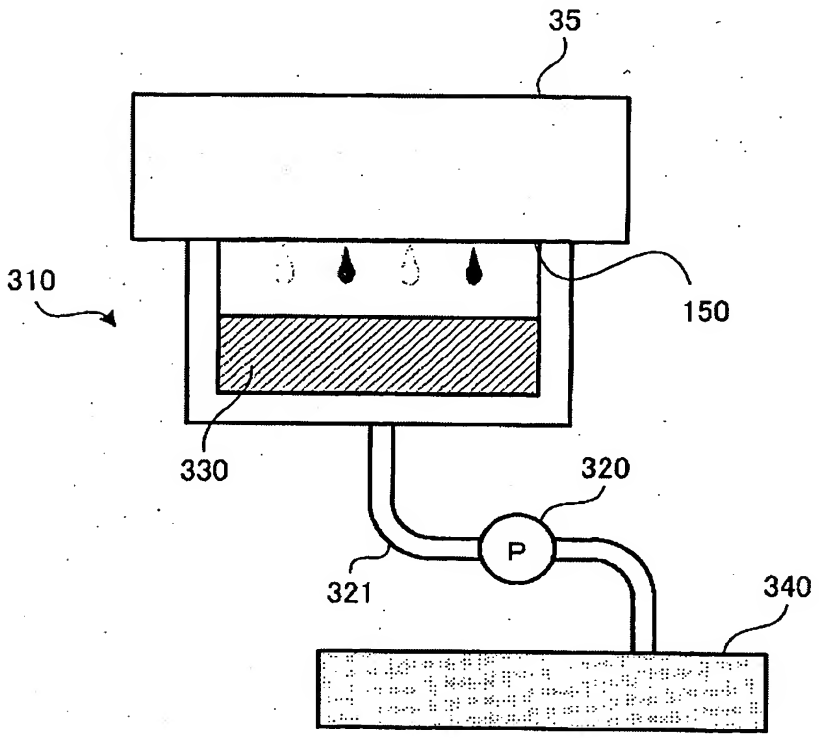

Fig. 38

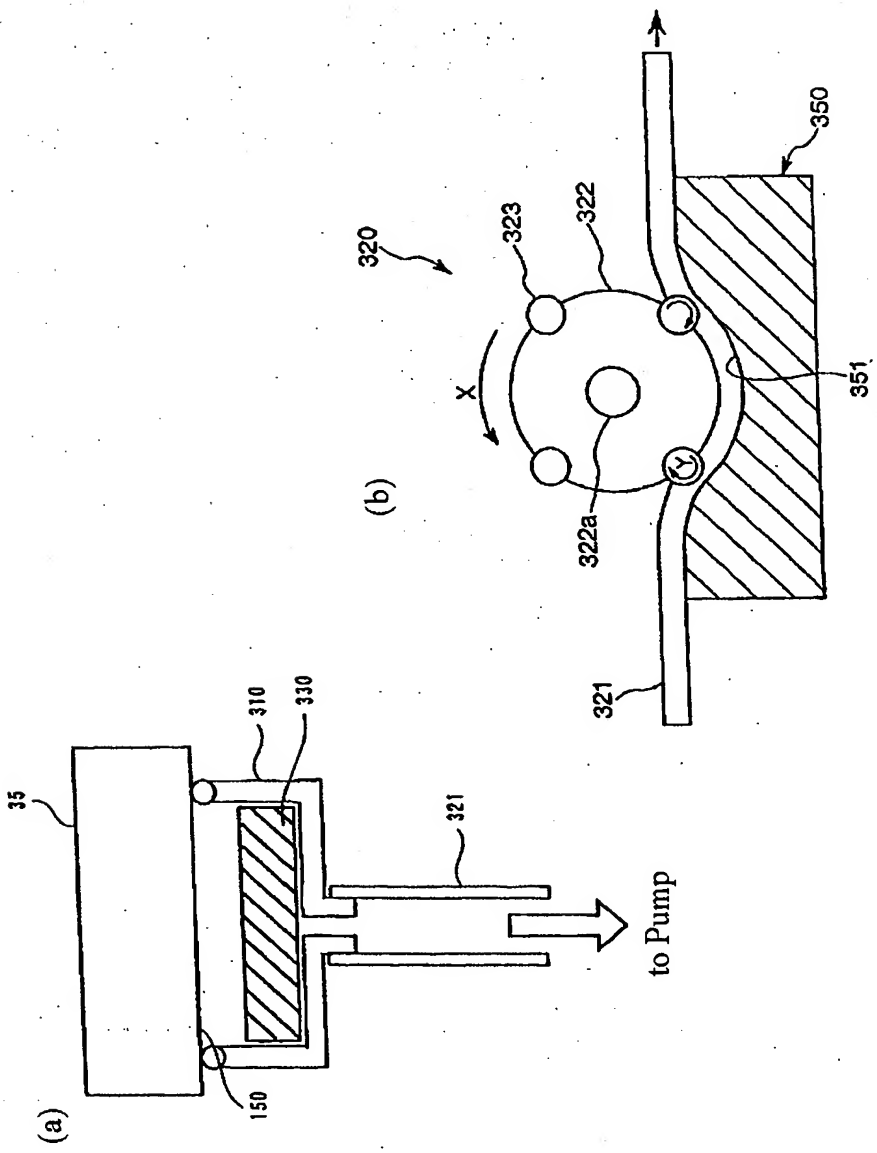

Fig. 39

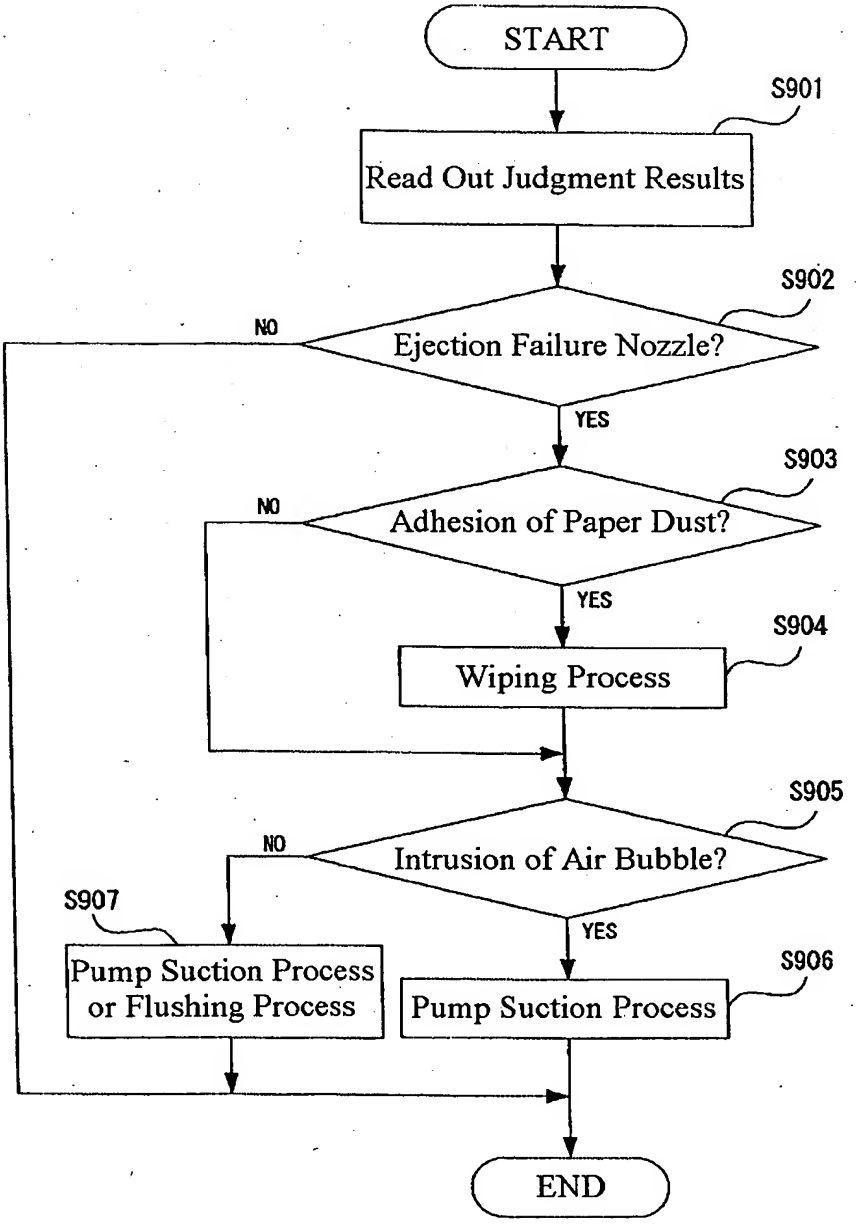
START
S901
Read Out Judgment Results
S902
NO
Ejection Failure Nozzle?
YES
S903
NO
Adhesion of Paper Dust?
YES
S904
Wiping Process
S905
NO
Intrusion of Air Bubble?
S907
YES
Pump Suction Process
or Flushing Process
S906
Pump Suction Process
END

Fig. 40

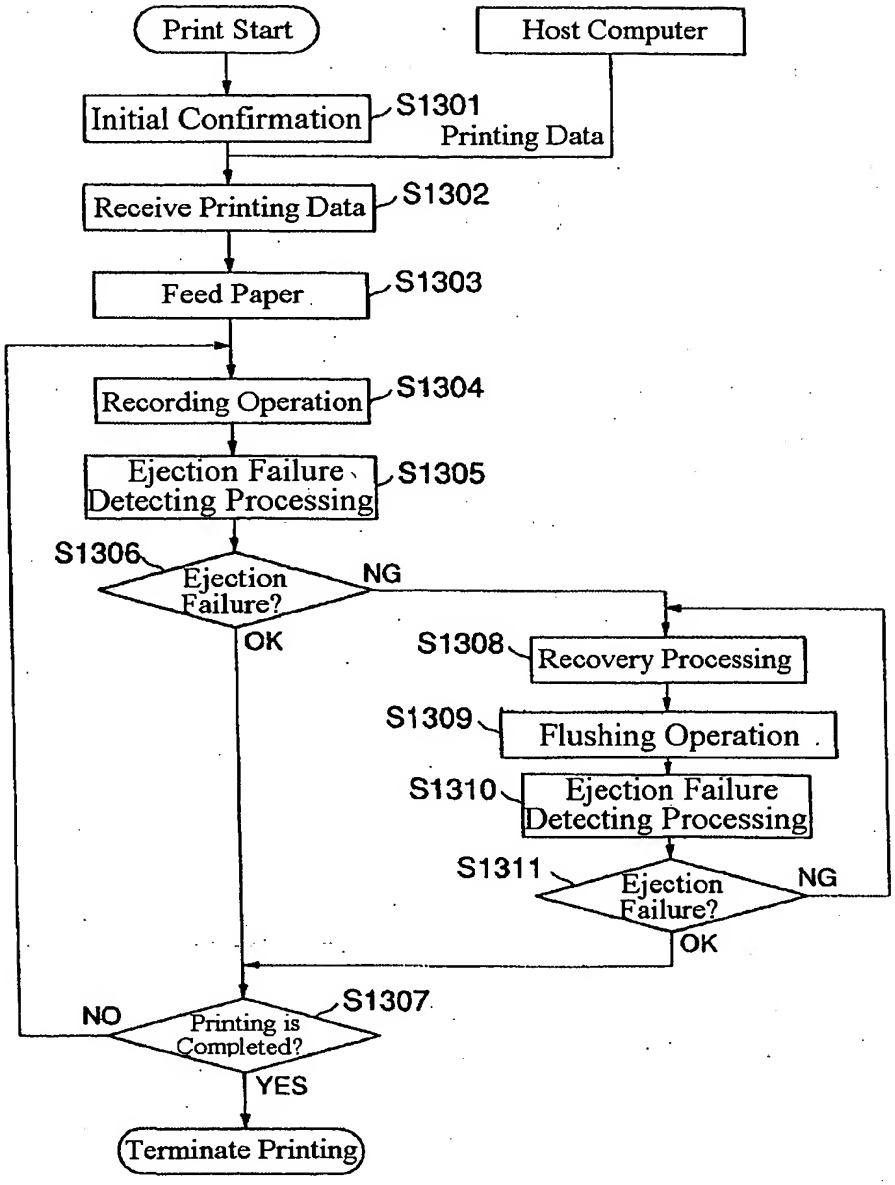
Print Start
Host Computer
Initial Confirmation
S1301
Printing Data
Receive Printing Data
S1302
Feed Paper
S1303
Recording Operation
S1304
Ejection Failure Detecting Processing
S1305
S1306
Ejection Failure?
NG
OK
S1308
Recovery Processing
S1309
Flushing Operation
S1310
Ejection Failure Detecting Processing
S1311
Ejection Failure?
NG
OK
S1307
NO
Printing is Completed?
YES
Terminate Printing

Fig. 41

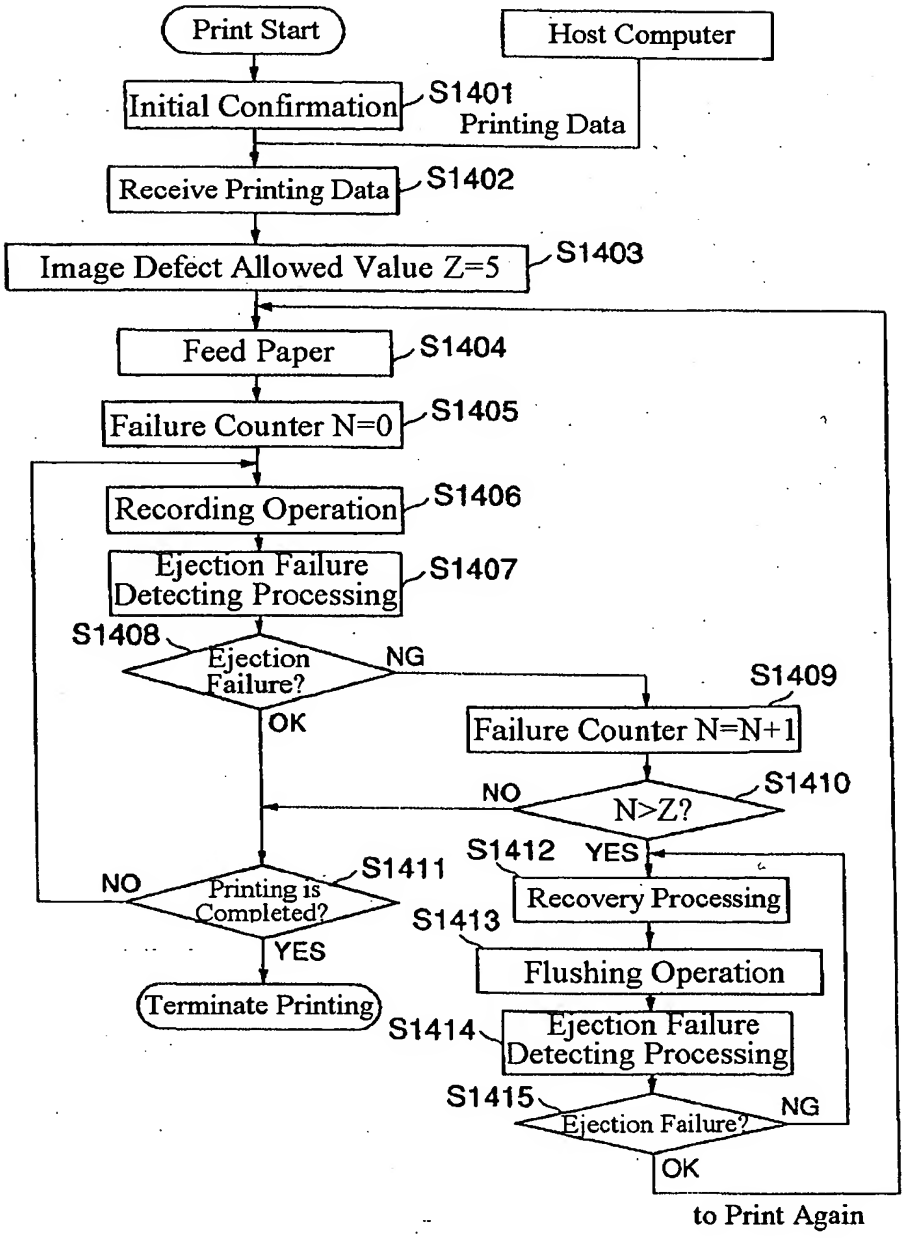
Print Start
Host Computer
Initial Confirmation
S1401
Printing Data
Receive Printing Data
S1402
Image Defect Allowed Value Z=5
S1403
Feed Paper
S1404
Failure Counter N=0
S1405
Recording Operation
S1406
Ejection Failure Detecting Processing
S1407
S1408
Ejection Failure?
NG
OK
S1409
Failure Counter N=N+1
NO
N>Z?
S1410
YES
S1412
Recovery Processing
NO
Printing is Completed?
S1411
YES
S1413
Flushing Operation
Terminate Printing
S1414
Ejection Failure Detecting Processing
S1415
Ejection Failure?
NG
OK
to Print Again

Fig. 42

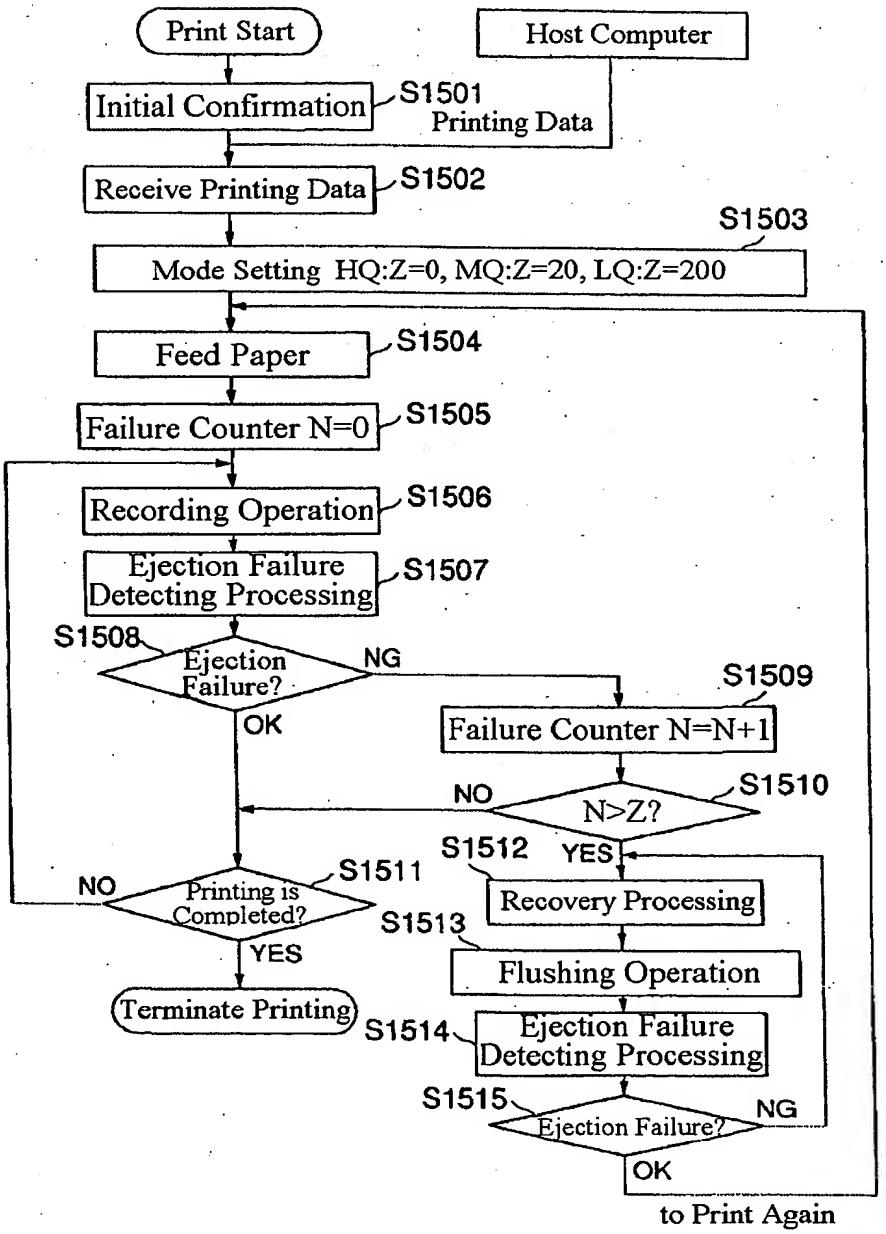
Print Start
Host Computer
Initial Confirmation
S1501
Printing Data
Receive Printing Data
S1502
S1503
Mode Setting HQ:Z=0, MQ:Z=20, LQ:Z=200
Feed Paper
S1504
Failure Counter N=0
S1505
Recording Operation
S1506
Ejection Failure Detecting Processing
S1507
S1508
Ejection Failure?
NG
S1509
OK
Failure Counter N=N+1
NO
N>Z?
S1510
S1512
YES
NO
Printing is Completed?
S1511
Recovery Processing
S1513
YES
Flushing Operation
Terminate Printing
S1514
Ejection Failure Detecting Processing
S1515
Ejection Failure?
NG
OK
to Print Again

Fig. 43

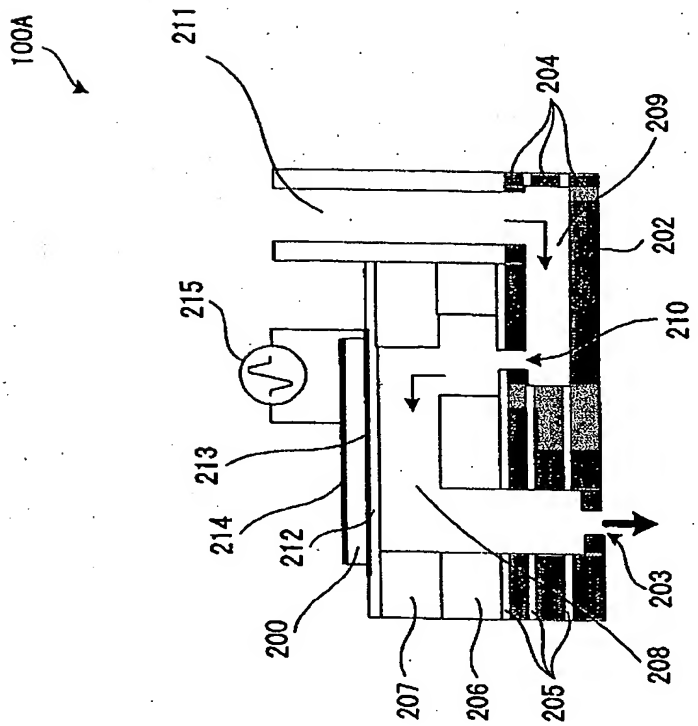

Fig. 44

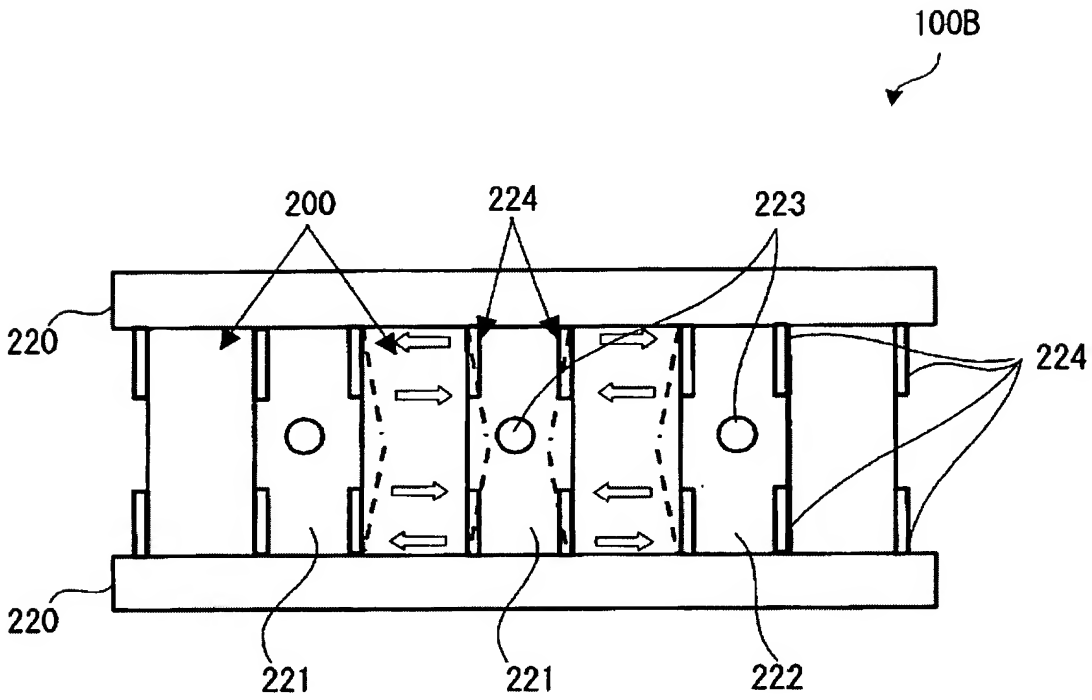

Fig. 45

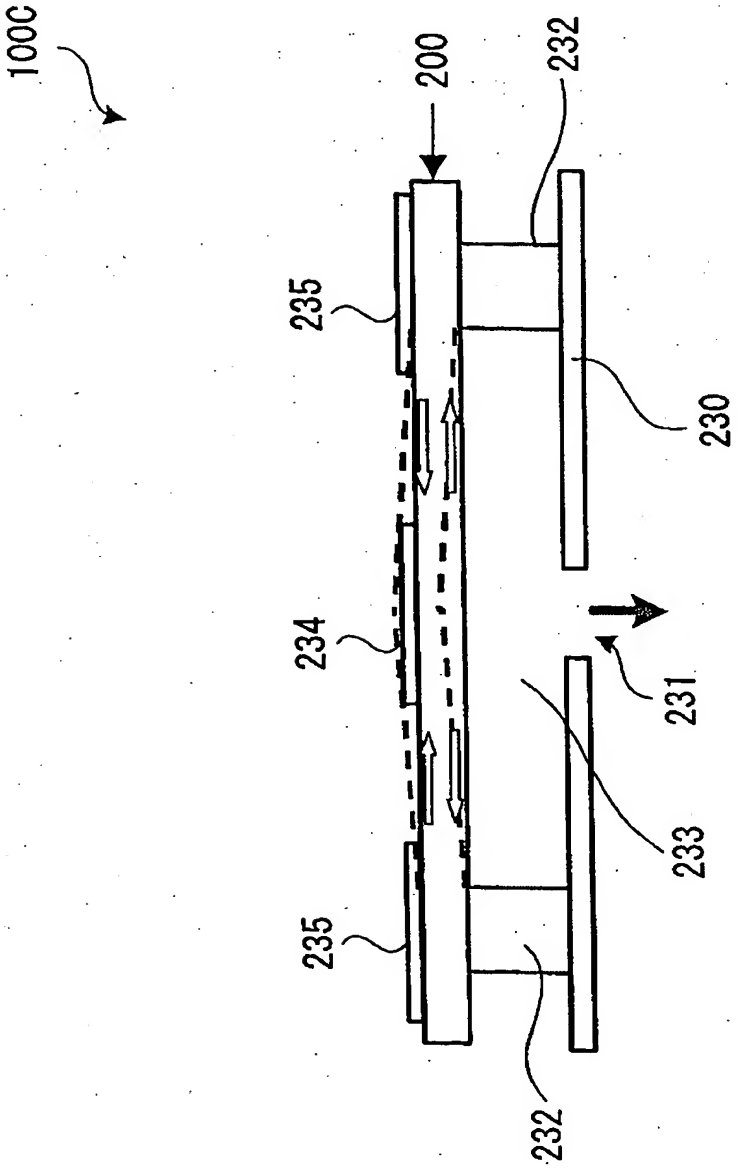

Fig. 46

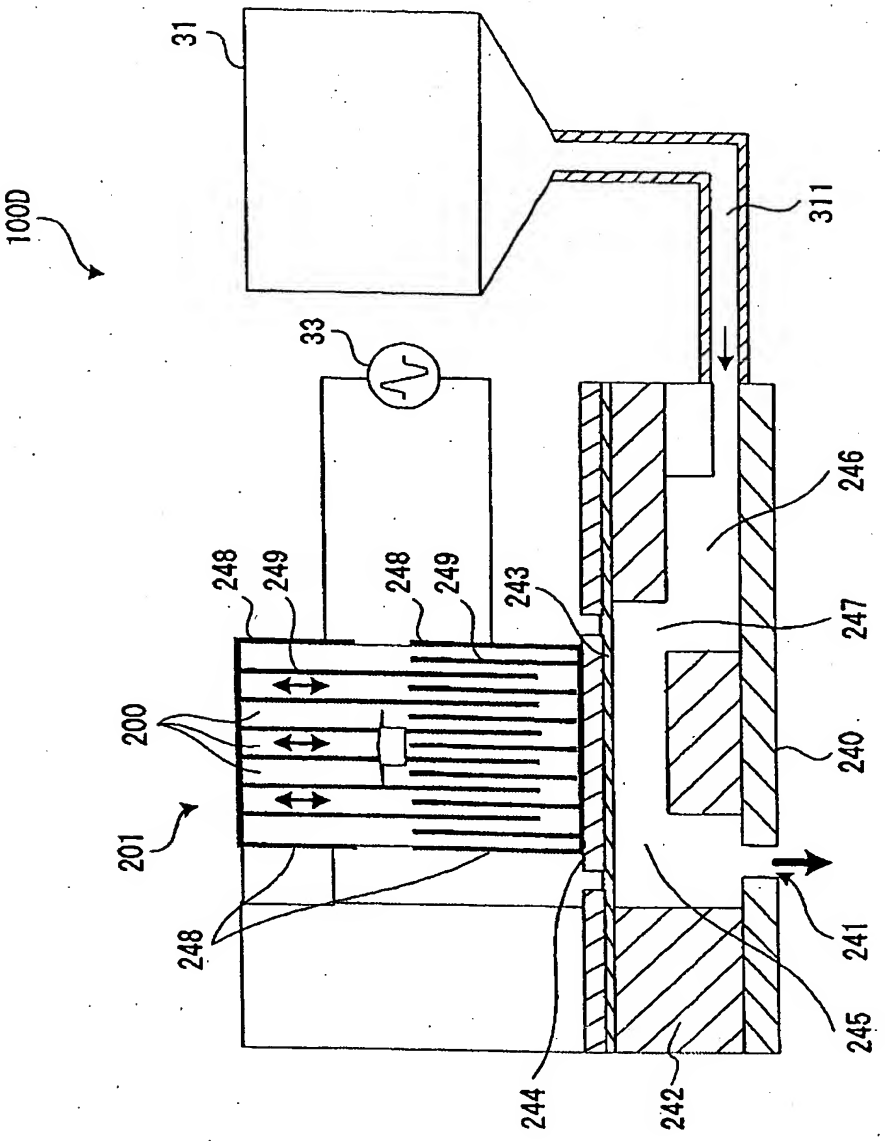
31
100D
311
33
246
248
249
248
249
243
247
200
240
201
241
248
245
244
242

Fig. 47